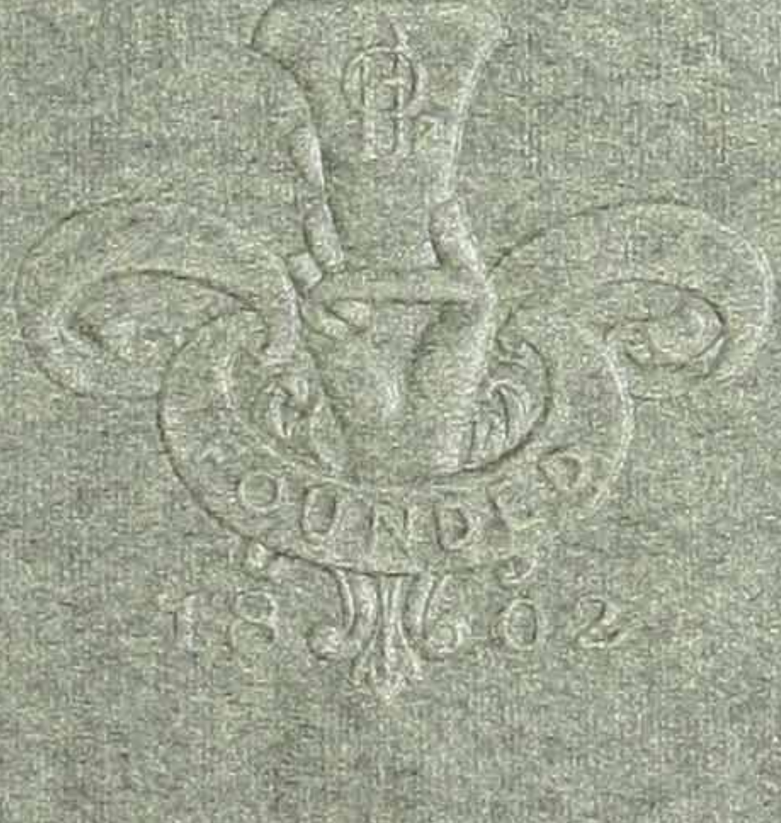
WATER PURIFICATION FOR ALL PURPOSES



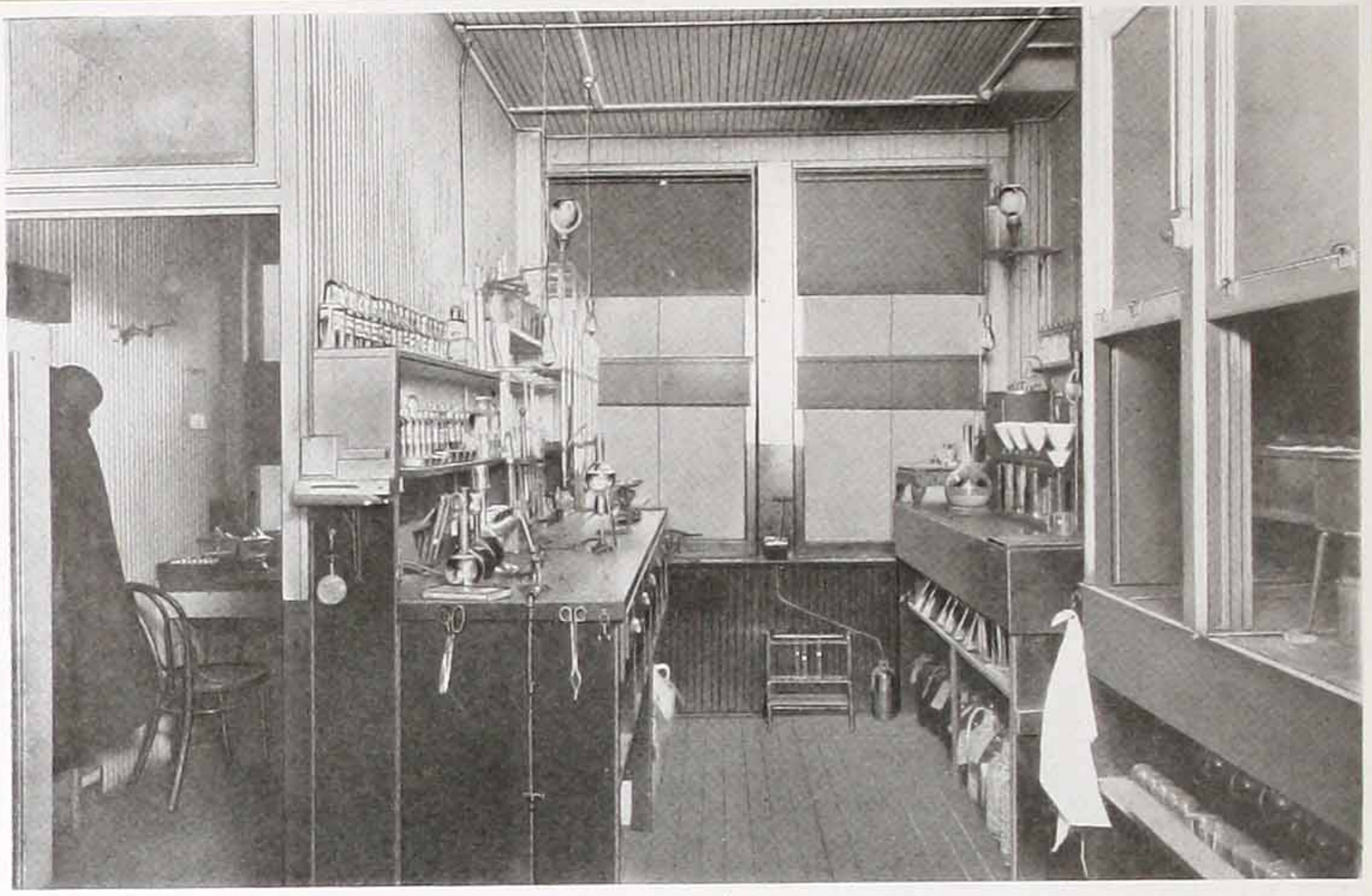
WM B. SCAIFE & SONS CO.
PITTSBURG, PA.

WATER
PURIFICATION
FOR ALL PURPOSES

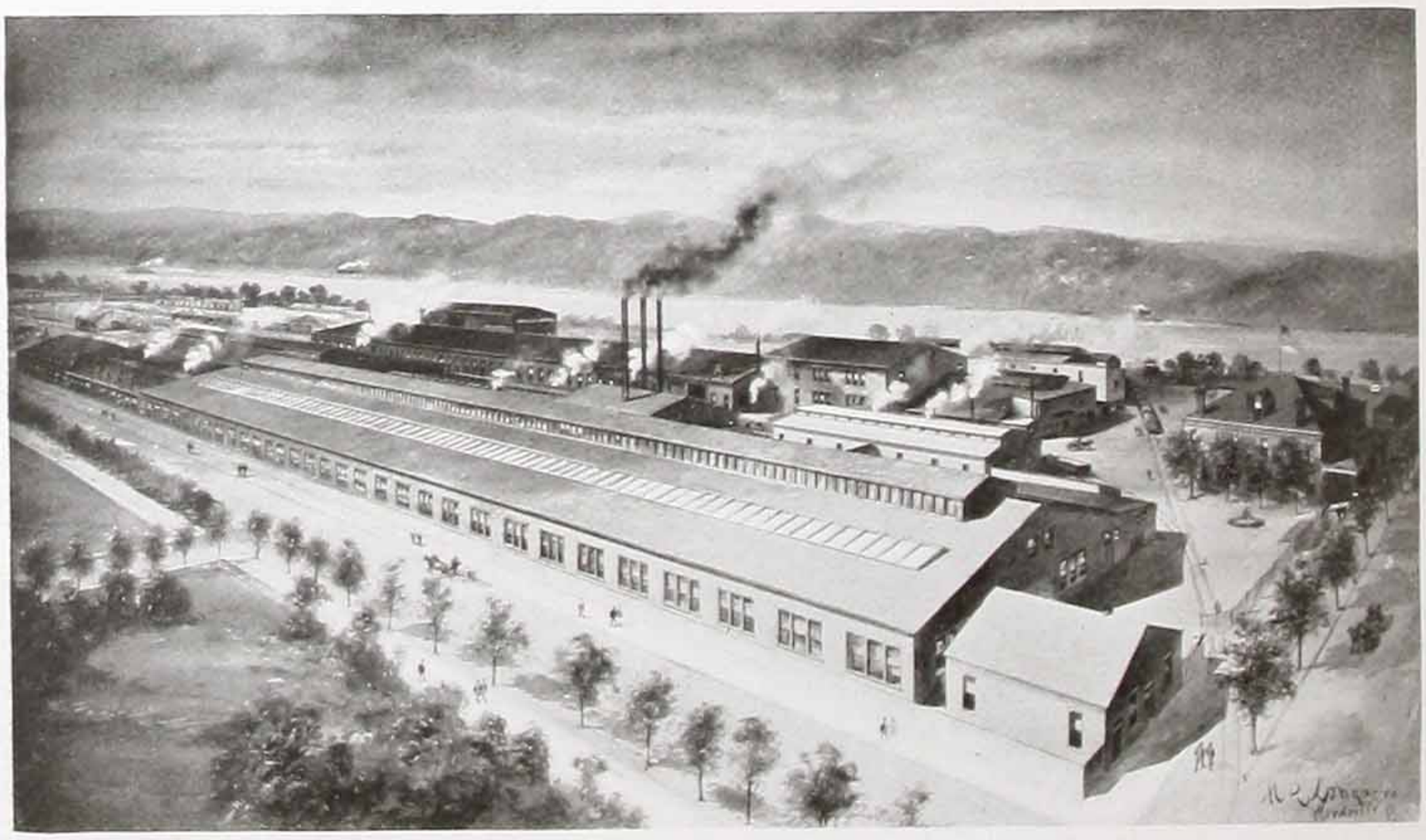
An illustrated treatise on the purification of water

SCAIFE *and* WE-FU-GO SYSTEMS

Wm. B. Scaife *and* Sons Co.
221 First Avenue
Pittsburg, Pa.
Founded, 1802



OUR LABORATORY



OUR WORKS, OAKMONT, PA.

Introductory

IN this catalog it is our desire to call particular attention to that branch of our business relating to the filtering, softening and purifying of water. We beg to assure prospective customers that the statements made herein are based upon a wide experience gained in the installation of over 500 water softening systems, treating more than 300,000,000 gallons of water daily; and of several thousand filtering systems.

The We-Fu-Go and Scaife Systems have been favorably before the public for many years, and have received the unqualified endorsement of our most discriminating users; so that their merits are generally conceded.

This department of our business is in the hands of chemists and engineers, experts in their respective lines, who make a special study of the subject, and devote their entire energies and attention to it. We spare neither time nor expense to accomplish results, and our long list of satisfied users is evidence of the success with which we have met in furnishing a simple and perfect device to bring about the purification of water for any and every purpose.

Patents

OUR systems are fully protected by letters patent. We own and control 32 United States patents, with others pending. Constant improvements are being made in the details of our apparatus, after they have been thoroughly tried out on our own experimental plants. We also purchase the patents of others, if we find that their use will improve our apparatus and give to our customers better service.

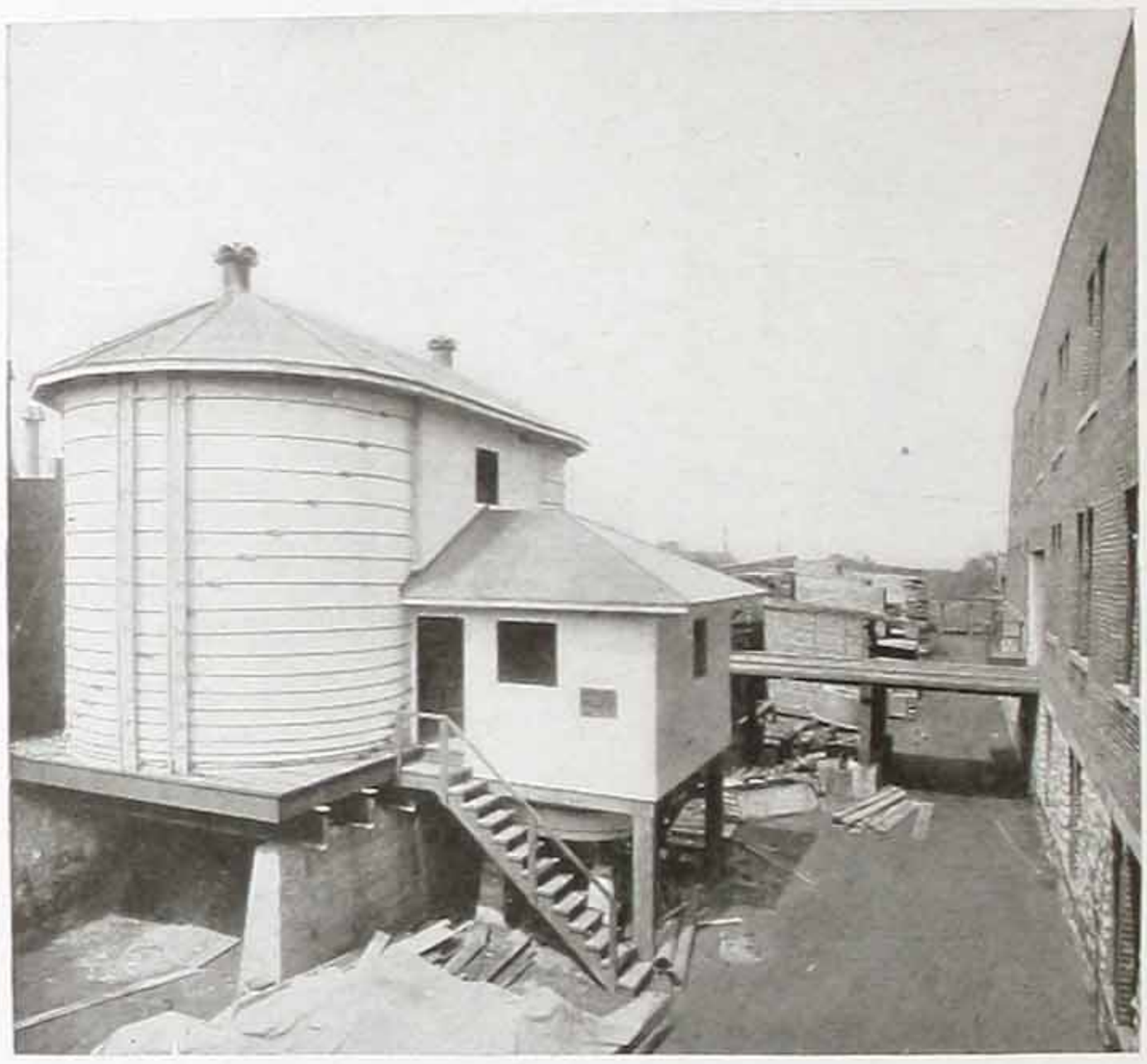
We have trade-marked the names of our systems to protect the unsuspecting against imitations.

All our catalogs, instructions for operation, and directions for testing, are copyrighted.

In making our contracts for the installation of plants for filtering, softening and purifying water, we guarantee users against loss by litigation relative to patents, trade-marks and copyrights. On the other hand, any infringement of our patents, trade-marks and copyrights will be vigorously prosecuted.

Impurities

ALL water on the surface of the earth, or beneath, has at some time descended from the clouds as rain. In its descent to the earth it absorbs carbonic acid, some air and other impurities. The carbonic acid absorbed enables it to dissolve certain salts of lime and magnesia. Other substances will be dissolved, depending upon the nature of the rocks, soil, vegetation, sewage and industrial waste.



1,800 H. P. WE-FU-GO SYSTEM
Globe-Wernicke Co.
Norwood, O.

The impurities common to our water supplies are tabulated below:

Carbonates of lime, magnesia, sodium and potassium.
Sulphates of lime, magnesia, sodium and potassium.
Nitrates of lime, magnesia, sodium and potassium.
Chlorides of lime, magnesia, sodium and potassium.
Silica, oxides of iron and alumina.
Suspended matter, including mud and sand.
Organic matter.
Carbonic acid.

Any or nearly all of the impurities mentioned above may be present in a natural water.

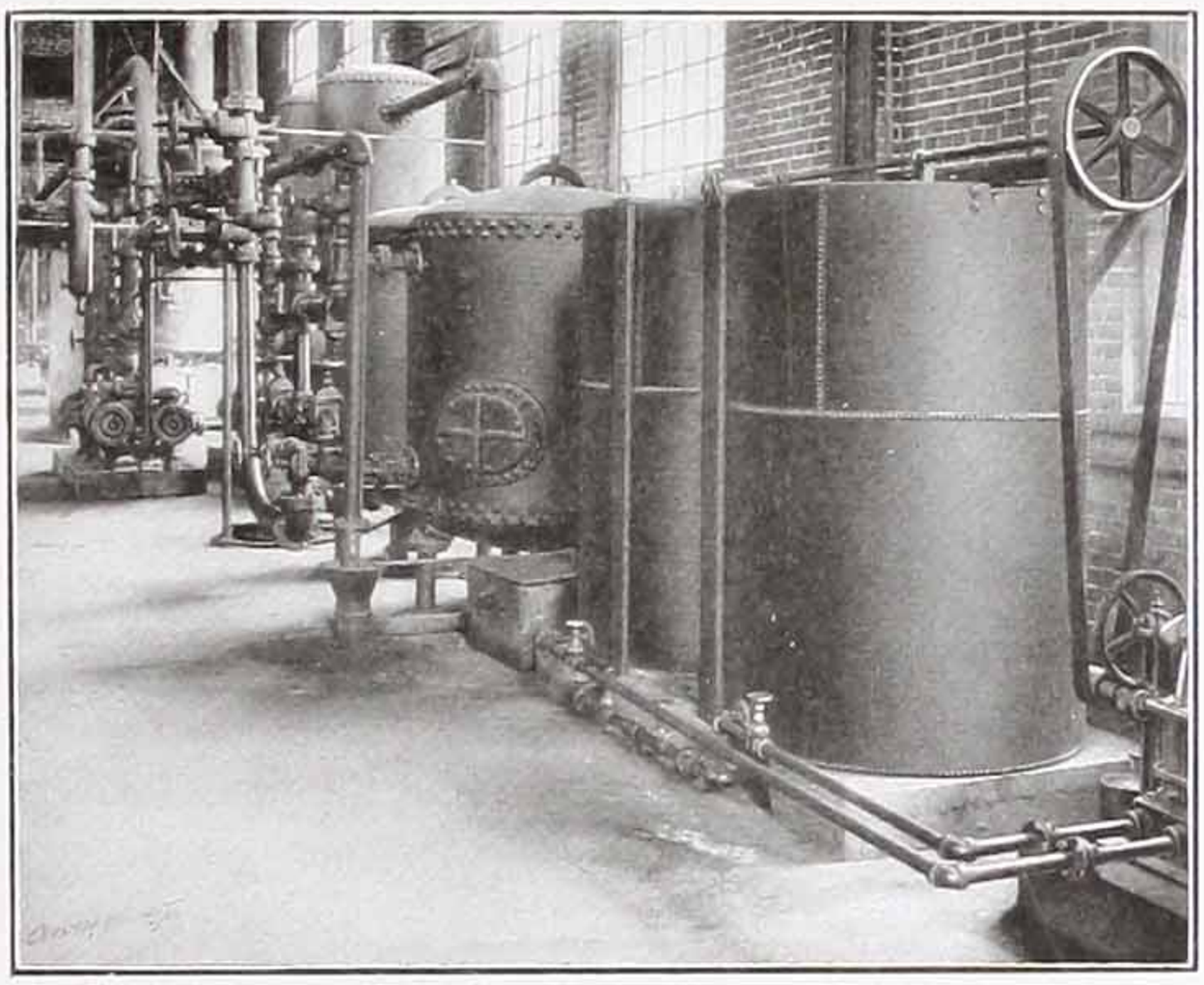
Contamination from sewage and industrial waste may introduce the following impurities:

Sulphuric acid,	Acetic, tannic and other	Organic matter,
Hydrochloric acid,	organic acids,	Suspended matter.

Water Softening

TRUE water softening is the removal of those soluble impurities which make water hard. Sedimentation and filtration is efficient for the removal of suspended matter and bacterial purification. Purification by chemical precipitation and filtration is required for the removal of acids and hardening substances which are held in solution.

Filtration of a soft, dirty water is all that is required to fit it for any use; but when a water contains acids with lime and magnesia in solution, with or without suspended matter, it is absolutely impossible to remove any of the impurities in solution by sedimentation or filtration unless they can first be converted into a state of suspension by chemical treatment; this process is usually spoken of as the softening and purifying of water.



2,000 H. P. SCAIFE SYSTEM
Pittsburg Terminal Warehouse & Transfer Co.
Pittsburg, Pa.

Special apparatus is necessary to accomplish the softening and purification of water, and to get the best results from the reagents employed, it must be so designed that the following features, which enter into the chemical and mechanical purification, are included:

First, accurate chemical treatment.
Second, thorough mixture of reagents with water.
Third, accelerated chemical reaction.
Fourth, complete chemical reaction.
Fifth, rapid sedimentation.
Sixth, perfect clarification.

Our intermittent settling tank system meets all these conditions. Our continuous systems meet them as nearly as any continuous system possibly can.

Water Softening—Continued

First, Accurate Chemical Treatment—in our intermittent system is accomplished by treating a fixed quantity of water in the settling tanks, and by weighing out the exact quantity of each reagent required for softening, and in our Continuous system, by introducing the chemicals in direct proportion to flow of the water.

Section of boiler tube originally full of scale, showing disintegration of scale by softened water.

Second, Thorough Mixture—is obtained by means of our specially designed Mechanical Stirring Devices, which revolve to thoroughly mix the water and reagents together.

Third, Accelerated Chemical Reaction—is obtained by stirring the water and mixing the sludge of previous softening with the new finely divided precipitate.

Fourth, Complete Chemical Reaction—is brought about by having the apparatus large enough to allow time for all chemical changes to take place, and making every part of the apparatus effective for perfectly mixing the water with the reagents.

Fifth, Rapid Sedimentation—takes place because the mixing of the old precipitated sludge with the new precipitate weights it and causes it to settle more rapidly and perfectly.

Sixth, Perfect Clarification—in our system is accomplished by means of our Mechanical Filters (with crushed quartz bed, and brass strainers), which remove all suspended matter (not wood fibre or excelsior filters which need constant renewing).

Our work in this line is based on scientific knowledge and extensive experience.

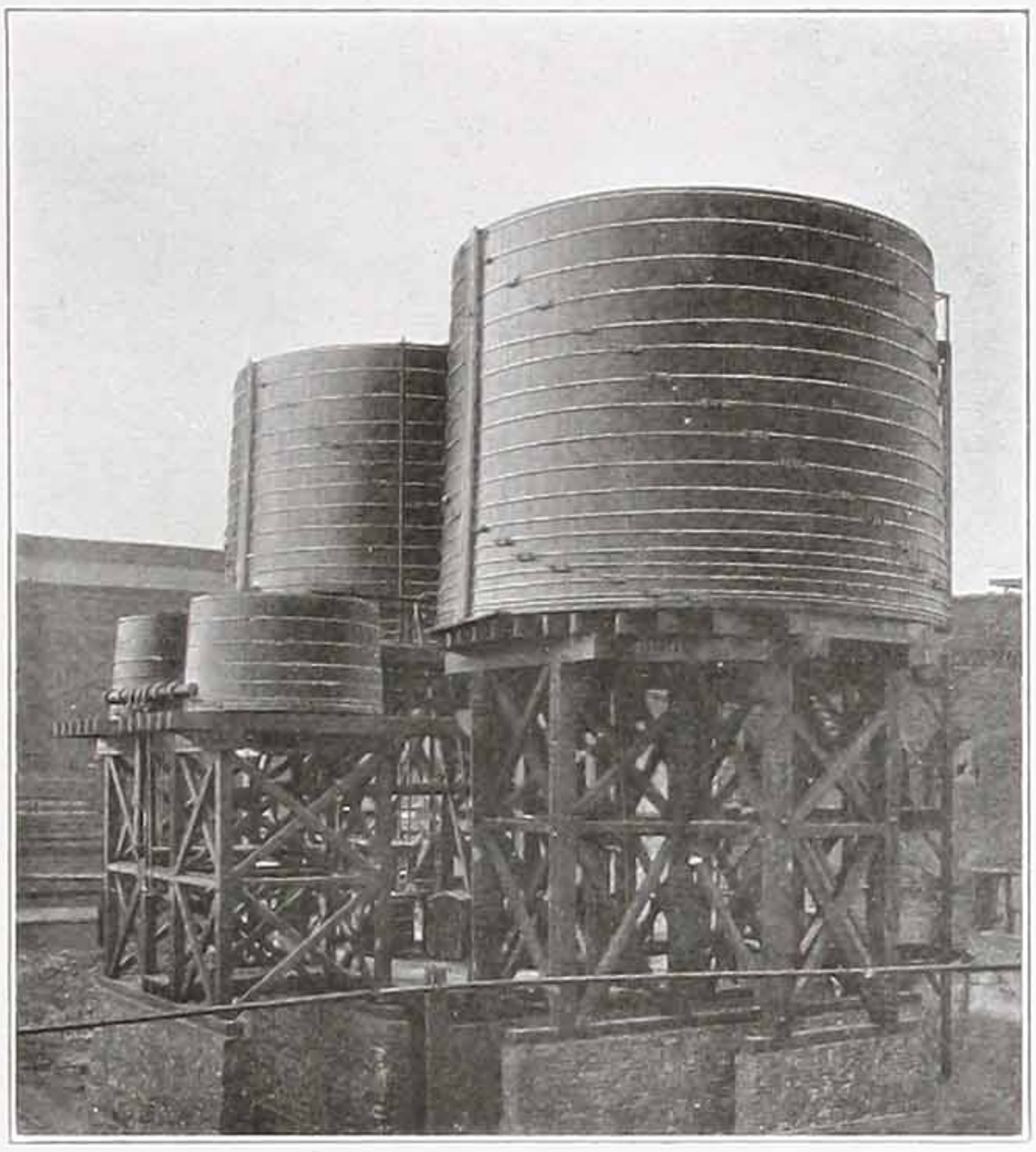
We keep in touch with users of our systems, and furnish gratuitously any information required to operate them properly; also check the treatment or analyze samples of water when requested.

Our guarantees are honest and possible, backed by ample financial standing.

(Upon application, we will be pleased to forward pamphlet on "Softening and Purification of Water.")

Chemistry of Water Softening

THE complete softening of a water requires the removal, both of its temporary and of its permanent hardness. The temporary hardness is caused by the carbonates of lime and magnesia being held in solution by an excess of carbonic acid. These carbonates, which are practically insoluble in pure water, can be precipitated by removing the carbonic acid, either by heat or by alkalies—the cheapest of which is quicklime. The two following reactions illustrate the removal of the temporary hardness by a lime treatment:



5,000 H. P. WE-FU-GO SYSTEM
Pennsylvania Salt Mfg. Co.
Natrona, Pa.

$$\underset{\substack{\text{Calcium}\\\text{Bi-carbonate}}}{CaCO_3CO_2} + \underset{\text{Lime}}{CaO} = \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{\underline{CaCO_3}} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{\underline{CaCO_3}}$$

$$\underset{\substack{\text{Magnesium}\\\text{Bi-carbonate}}}{MgCO_3CO_2} + \underset{\text{Lime}}{CaO} = \underset{\substack{\text{Magnesium}\\\text{Carbonate}}}{\underline{MgCO_3}} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{\underline{CaCO_3}}$$

The formulas underlined show insoluble substances precipitated. The lime treatment further converts the rather soluble magnesium carbonate into the insoluble magnesium hydrate, thus:

$$\underset{\substack{\text{Magnesium}\\\text{Carbonate}}}{MgCO_3} + \underset{\substack{\text{Lime}\\\text{Hydrate}}}{Ca(OH)_2} = \underset{\substack{\text{Magnesium}\\\text{Hydrate}}}{\underline{Mg(OH)_2}} + \underset{\substack{\text{Calcium}\\\text{Carbonate}}}{\underline{CaCO_3}}$$

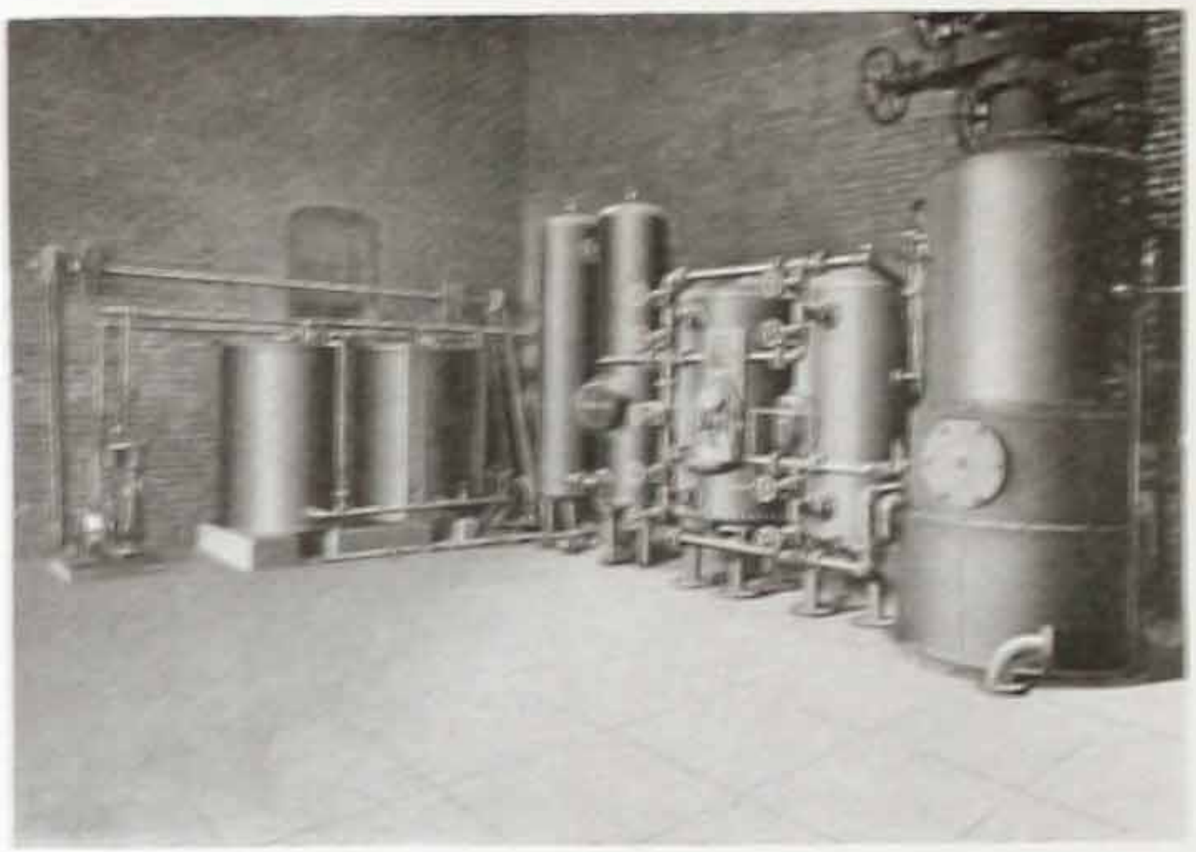
Lime also effects a practically complete removal of all magnesium compounds, for example:

$$\underset{\substack{\text{Magnesium}\\\text{Chloride}}}{MgCl_2} + \underset{\substack{\text{Lime}\\\text{Hydrate}}}{Ca(OH)_2} = \underset{\substack{\text{Magnesium}\\\text{Hydrate}}}{\underline{Mg(OH)_2}} + \underset{\substack{\text{Calcium}\\\text{Chloride}}}{CaCl_2}$$

Permanent hardness is caused by the sulphates, chlorides and nitrates of lime and magnesia. After the complete removal of all magnesium compounds by lime, as shown above, the remaining

permanent hardness of the water is removed by sodium carbonate (soda ash), which precipitates the insoluble calcium carbonate, thus:

$CaSO_4$	+	Na_2CO_3	=	$CaCO_3$	+	Na_2SO_4
Calcium Sulphate		Soda Ash		Calcium Carbonate		Sodium Sulphate
$CaCl_2$	+	Na_2CO_3	=	$CaCO_3$	+	2 NaCl
Calcium Chloride		Soda Ash		Calcium Carbonate		Sodium Chloride



300 H. P. SCAIFE SYSTEM
Geo. J. Renner, Jr., Brewery
Youngstown, O.

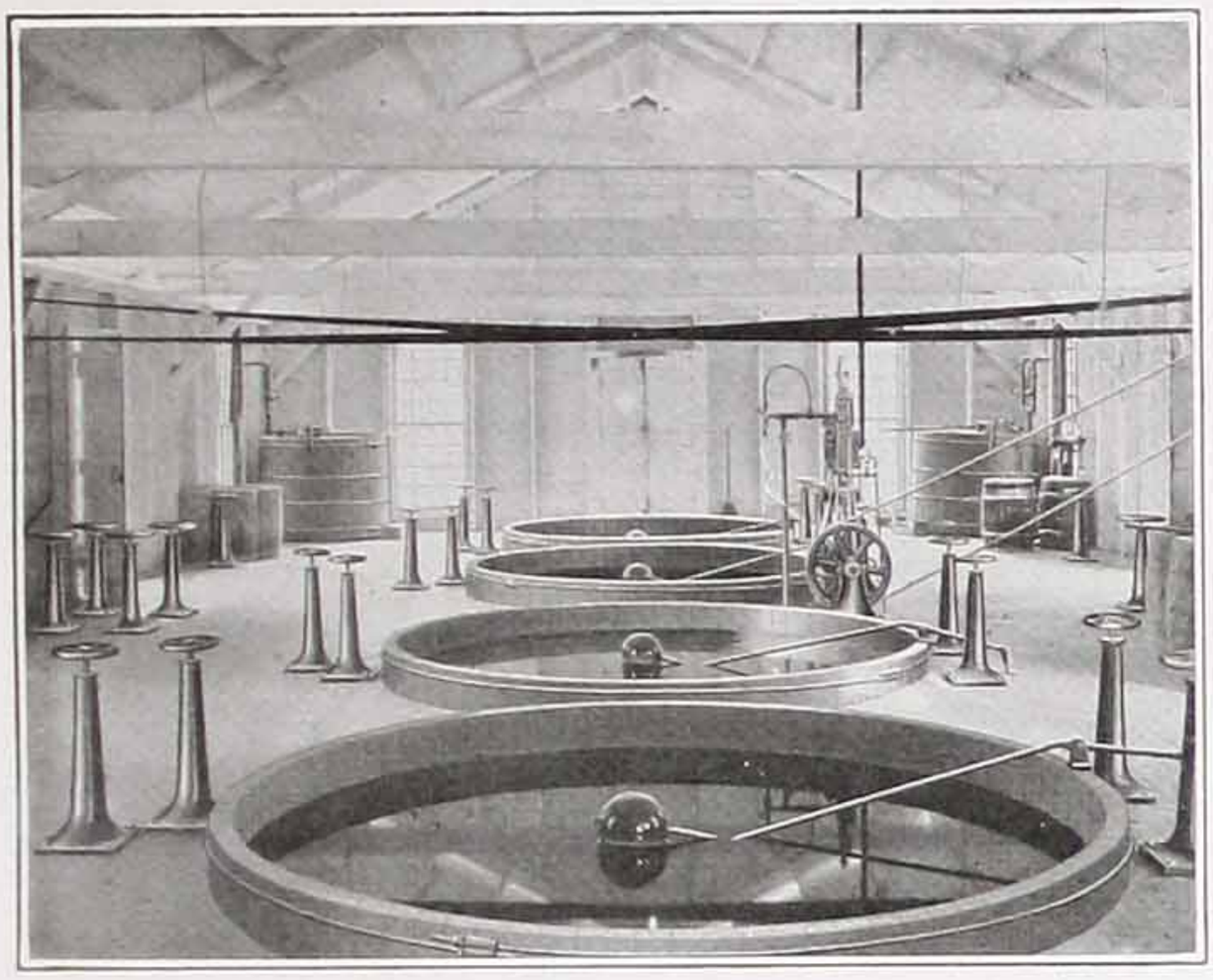
The sodium sulphate and sodium chloride left in solution are neutral, non-corrosive, non-scaling and non-hardening.

If, however, the water contains much calcium sulphate, the soda treatment gives a water correspondingly high in sodium sulphate, and this, in some instances, is undesirable. In such cases we prescribe special treatment, to avoid the formation of the soluble sodium salts.

The presence of other impurities will call for many chemical reactions not shown in the above example.

The above reactions give some idea of the methods used to determine the exact quantity of reagents required to properly soften any particular water. After making a careful analysis of the water, we use these reactions or equations to calculate the reagents, and we then check our results by an experimental treatment of the water. We are thus able to positively guarantee just exactly what we can do with a water, know how to accomplish the desired results, and are prepared to stand by our guarantee.

Water Analysis

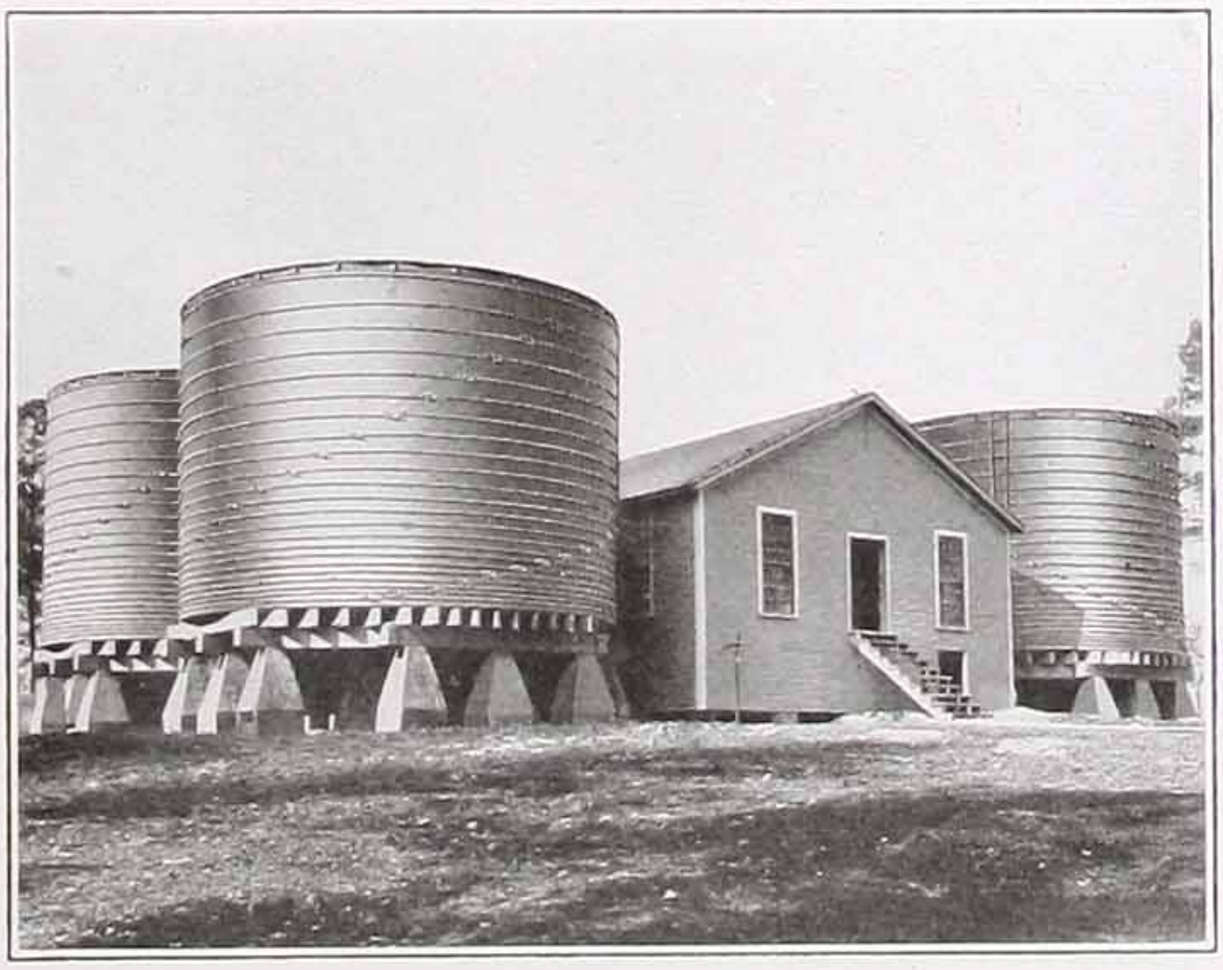


Interior View, 10,800 H. P. WE-FU-GO SYSTEM
Woodward Iron Co.
Woodward, Ala.

WE have a complete laboratory equipment, used solely and entirely for the purpose of making water analyses. A complete and careful analysis of the water to be treated is of such vital importance in determining the treatment and apparatus to be used, that we spare neither time nor expense to make this branch of our work as nearly perfect as possible.

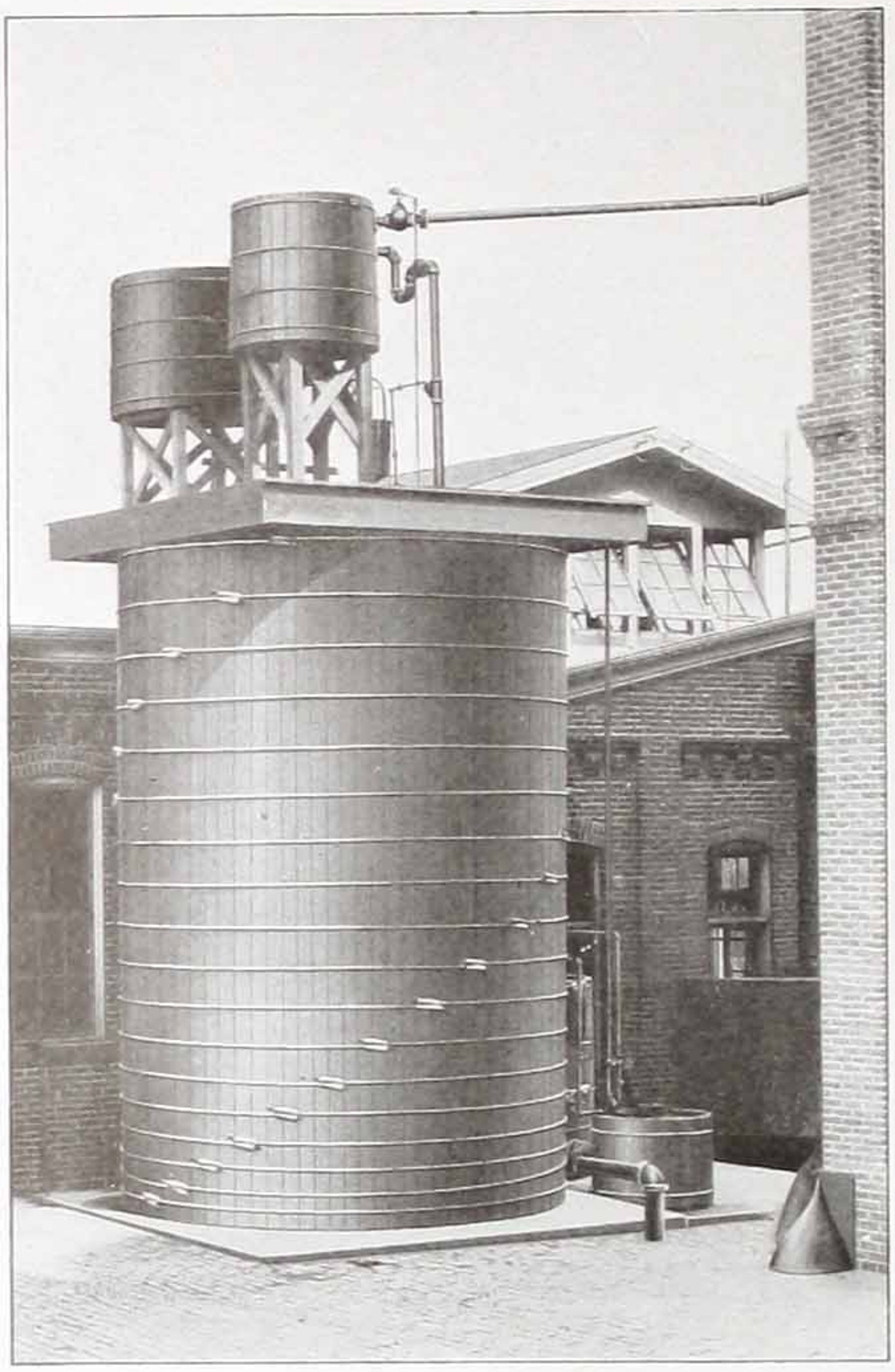
In sending us a sample of water for analysis, secure a sample that represents the average condition of the supply; taken as near the intake as possible. Use a clean, glass bottle of at least one gallon capacity. Rinse thoroughly with the water to be analyzed, then fill to within one-half inch of the neck of the bottle. Tightly insert glass stopper, or clean, new cork. Do not put any sealing wax over the cork. Do not use a jug if you can possibly avoid it.

Carefully mark the name and address of sender, with the source of supply from which the water is taken, so that we may have proper record of the sample. A tag with directions for sending sample will be furnished on application.



Exterior View, 10,800 H. P. WE-FU-GO SYSTEM
Woodward Iron Co.
Woodward, Ala.

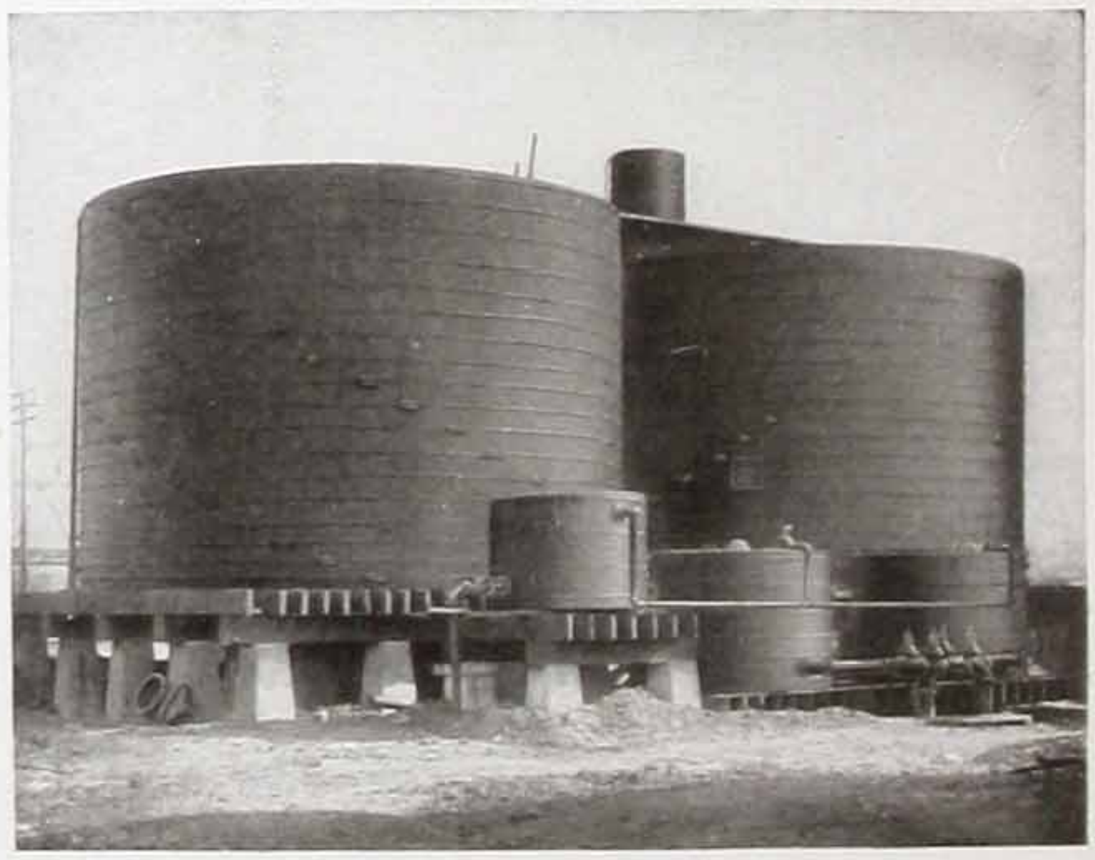
Types of Water Softening and Purifying Systems



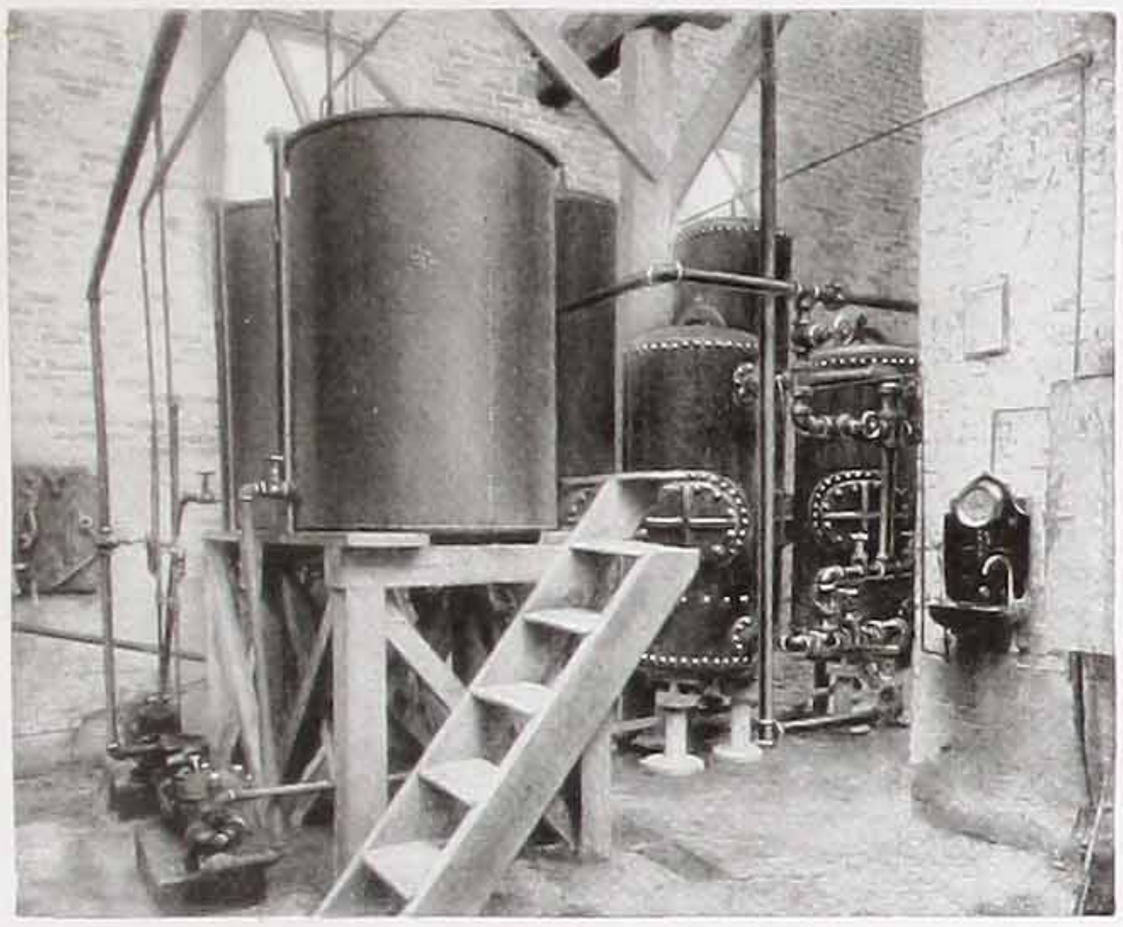
600 H. P. SYPHON SYSTEM
George Gunther, Jr., Brewing Co.
Baltimore, Md.

WE build every type of apparatus for softening and purifying water, treating the water hot or cold, by gravity or under pressure, each being particularly adapted to certain specific requirements. We are therefore in a position to advise as to the type of system best adapted to a particular use or set of conditions. The various types are divided into two distinct classes; the Continuous, and the Intermittent.

The best that can possibly be accomplished in a Continuous apparatus is the introduction of reagents proportional to the flow of water; and adjustment must be made in the quantity of reagents introduced to meet every variation or change in the water. Then, too, no matter how carefully or how accurately designed an apparatus may be, an error must necessarily be introduced when wide variations occur in the quantity of water handled.



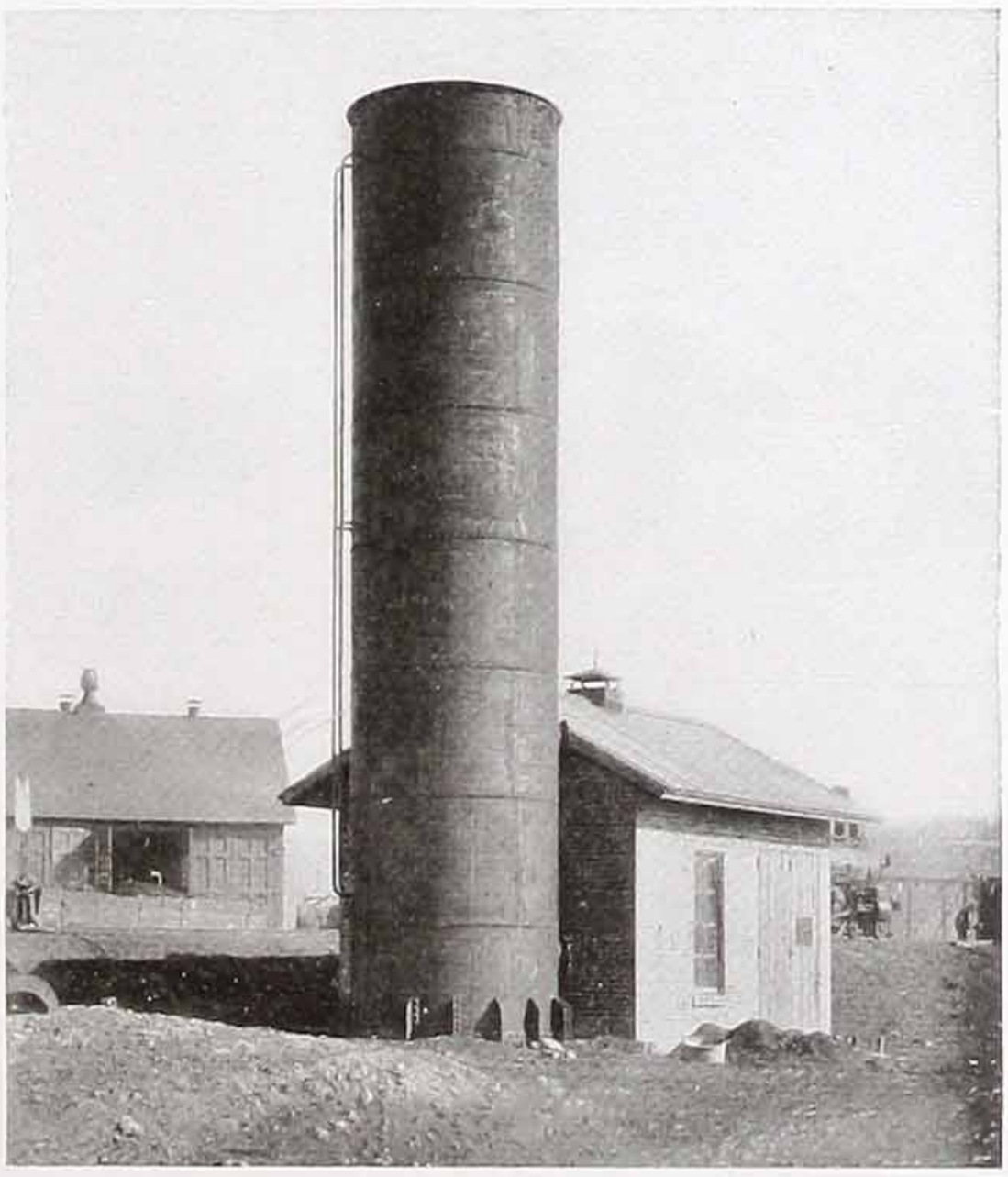
4,000 H. P. WE-FU-GO SYSTEM
South Covington & Cincinnati Street Ry. Co.
Newport, Ky.



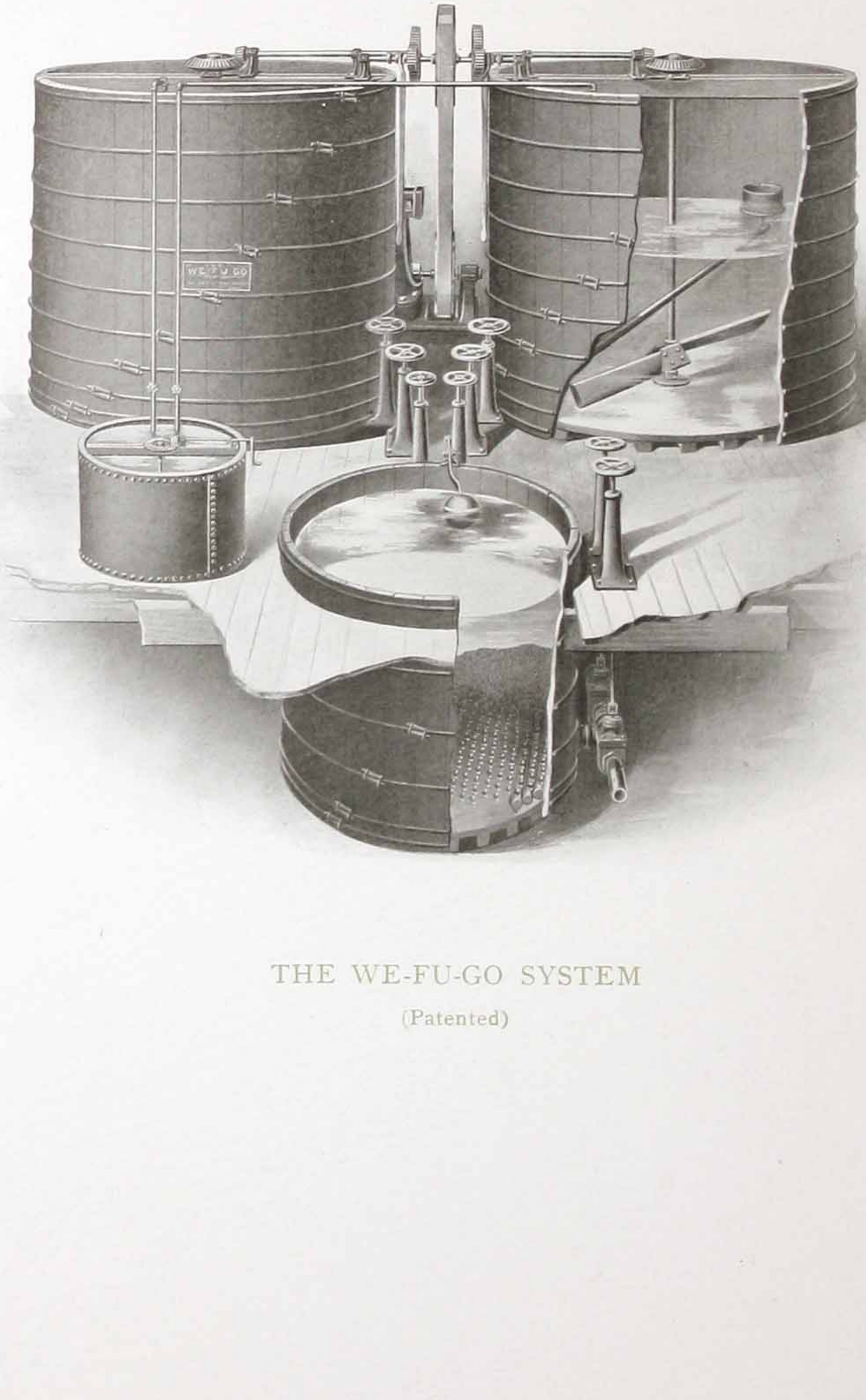
500 H. P. SCAIFE SYSTEM
Xenia Board & Paper Co.
Xenia, O.

In the Intermittent system, where definite quantities of water are treated all the time and the exact quantities of reagents required are weighed out, it is possible to treat accurately any water, no matter how it may vary as to quality or how the quantity used may be changed.

Water softening is an exact process, and the system by which water is accurately treated is the one for the best results. We do not mean to state, however, that the Intermittent system is the only one which will give satisfactory results; for there are conditions under which a Continuous system will give equally good results. We have Continuous systems in operation ranging from 400 gallons per hour to 150,000 gallons per hour, and Intermittent systems from 200 gallons per hour to 140,000 gallons per hour.



4,000 gallons per hour
WE-FU-GO CONTINUOUS SYSTEM
C., M. & St. P. Ry. Co.
Sioux City, Ia.



THE WE-FU-GO SYSTEM

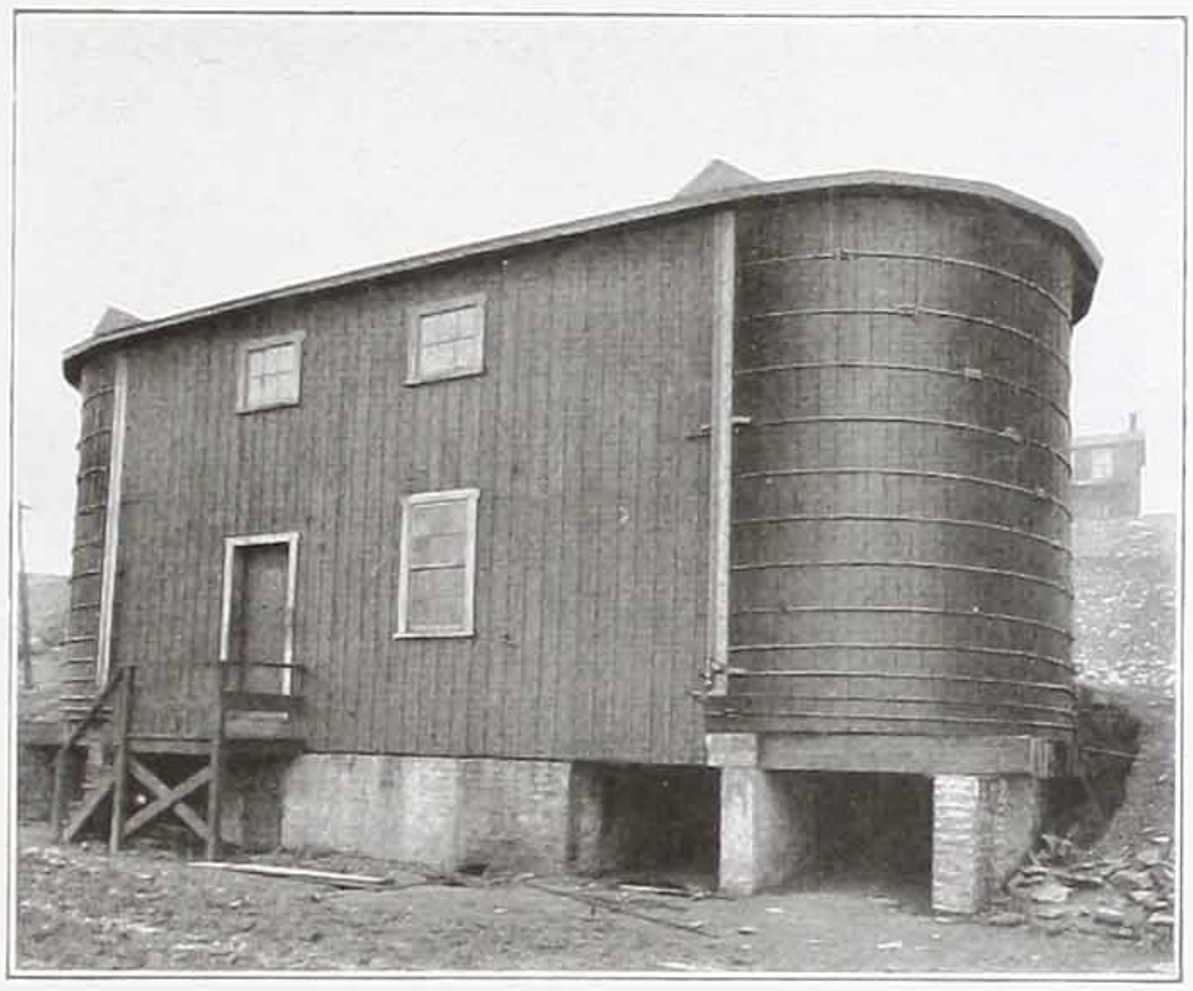
(Patented)

The We-Fu-Go System

Intermittent

THIS system consists essentially of two or more treating and settling tanks, equipped with mechanical stirring devices operated by power, a small reagent or chemical mixing tank with mechanical stirring device and jet or other pump for introducing reagents into treating tanks, and a filter.

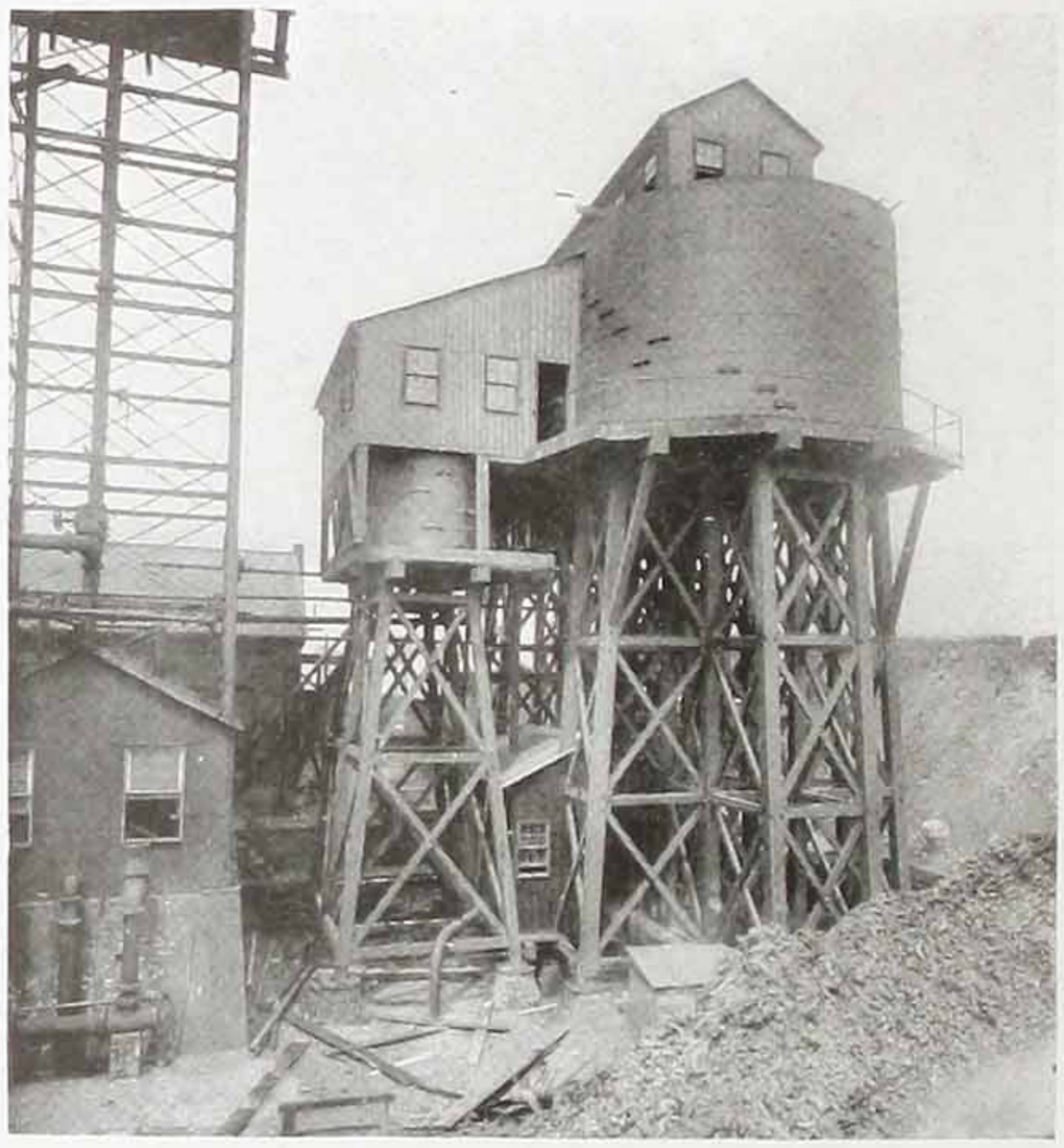
The treating tanks are filled alternately with water; while a tank is filling, the reagents are introduced and thoroughly mixed with the water by means of the mechanical stirring devices, consisting of a specially designed paddle, revolved by power from an available line shaft, an engine or a motor. The paddle not only mixes the reagents with the water, but at the same time stirs up from the bottom the lime sludge of preceding purification. This sludge floats in the water, hastens the chemical reaction, and causes the new finely divided precipitate to form large woolly flakes heavy enough to settle quickly as soon as the water stops moving. This mixing device is the simplest and most efficient that can be devised; with reasonable care it will not get out of order; it does not have to be cleaned to keep it in working condition; and it requires very little power.



1,250 H. P. WE-FU-GO SYSTEM
Rochester & Pittsburg Coal & Iron Co.
Punxsutawney, Pa.

After a tank is filled, the stirring device is stopped, and the water permitted to stand, in order to allow the precipitate to settle to the bottom of the tank. The softened water is taken out of the tank by means of a hinged floating outlet pipe, arranged to rise and fall with the level of the water, so that the water is always drawn from the top. The water at the top being the clearest, carries the least amount of floating sludge through

the floating outlet pipe to the filter-beds; therefore, the filters can be run the longest possible time without being cleaned. The rate of flow to the filters is automatically controlled, so that they are supplied with water as fast as it is drawn from them. Either pressure or gravity filters may be used; but in some cases no filter is necessary, depending on the kind of water treated and the purpose for which it is used.



6,000 H. P. WE-FU-GO SYSTEM
Carnegie Steel Co., Lucy Furnaces
Pittsburg, Pa.

While one tank is being filled, treated and settled, the other is supplying treated water; and by the time it is empty the first tank is ready to use. In this way a constant supply of accurately treated soft, clear water is always on hand.

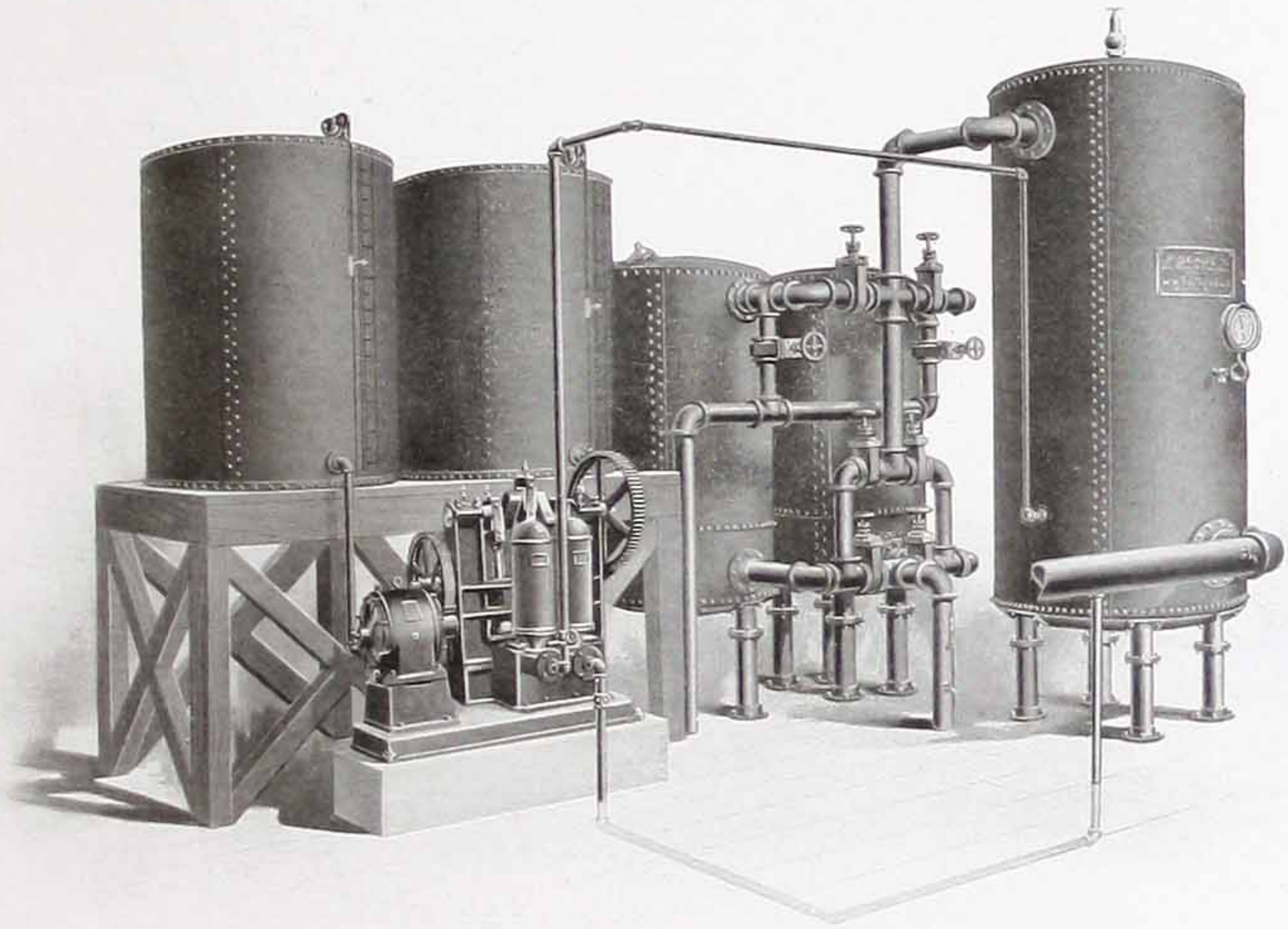
Pipe connections, through which to fill the tanks and to wash the sludge from the tanks, are placed in the bottom. The washing of the settling tanks needs to be done only about once a week, or when the sludge becomes deep enough to interfere with the rotation of the paddles. To do this, it is necessary only to open the valves to the sewer and start the stirring device to mix up the sludge, which is soft enough to flow through the pipe into any sewer.

The Scaife System

THIS system is intended to treat hot water under pressure, and is designed to occupy the minimum space possible, because the reactions in hot water under pressure are practically instantaneous.

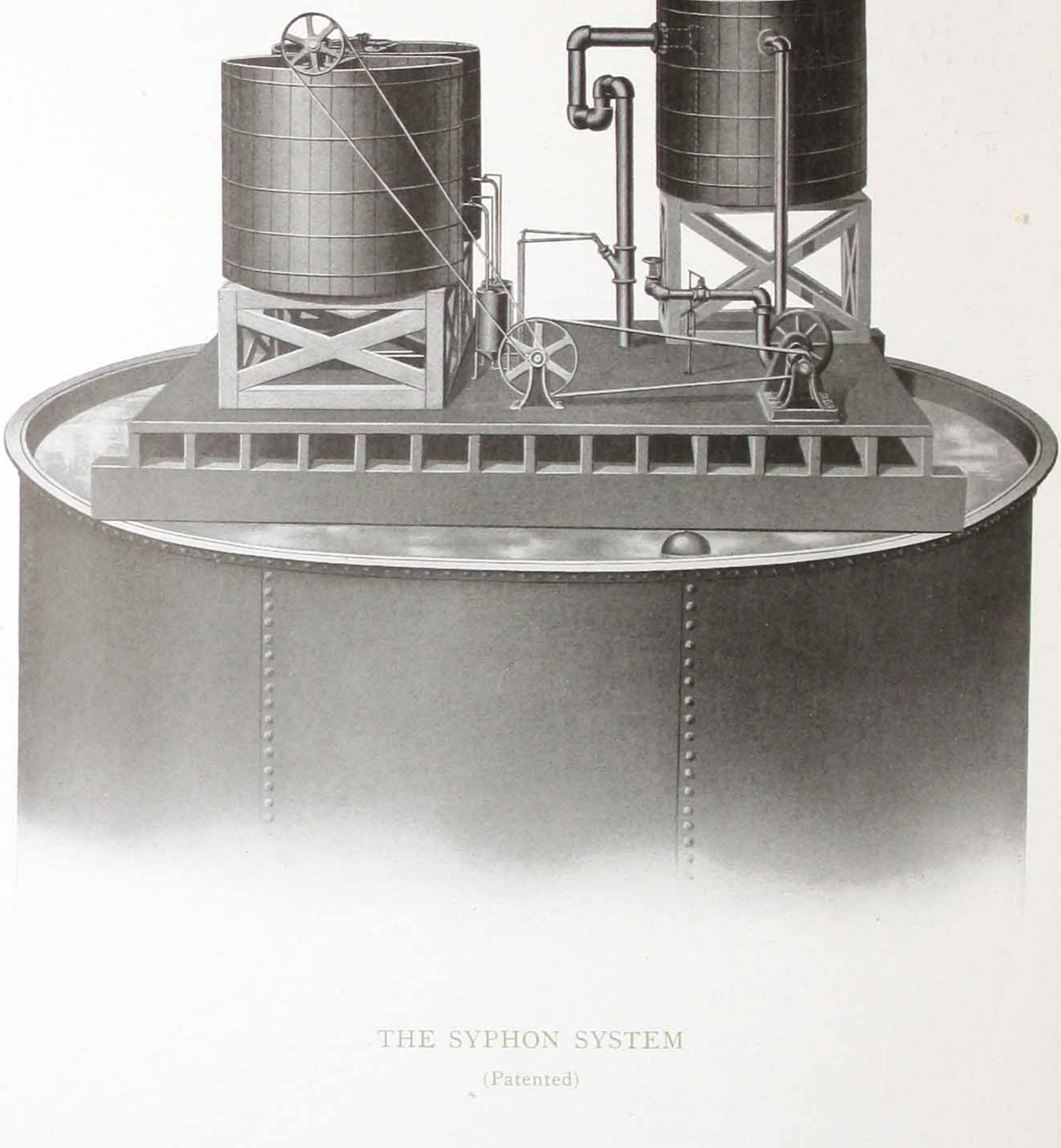
It consists of precipitating tanks, pressure filters, reagent solution tanks and pumps.

The water enters the system from the heaters under pressure. This heated water enters the precipitating tanks. Here the reagents



THE SCAIFE SYSTEM
(Patented)

are introduced from the solution tanks by a special pump or pumps. The water passes from the precipitating tanks to the filter, which effectually removes the remaining suspended matter. The precipitating tanks are so constructed that the water in the upper part is continually moving and mixing, while that in the lower part is static. In this system of treating water under pressure at temperatures of at least 175° F., the reactions are practically instantaneous and complete. The precipitate is coarse and heavy, and settles rapidly even in moving water; so that most of it can be blown out from the precipitating tanks, leaving little to be removed by the filters, which effect the final clarification of the water.



THE SYPHON SYSTEM

(Patented)

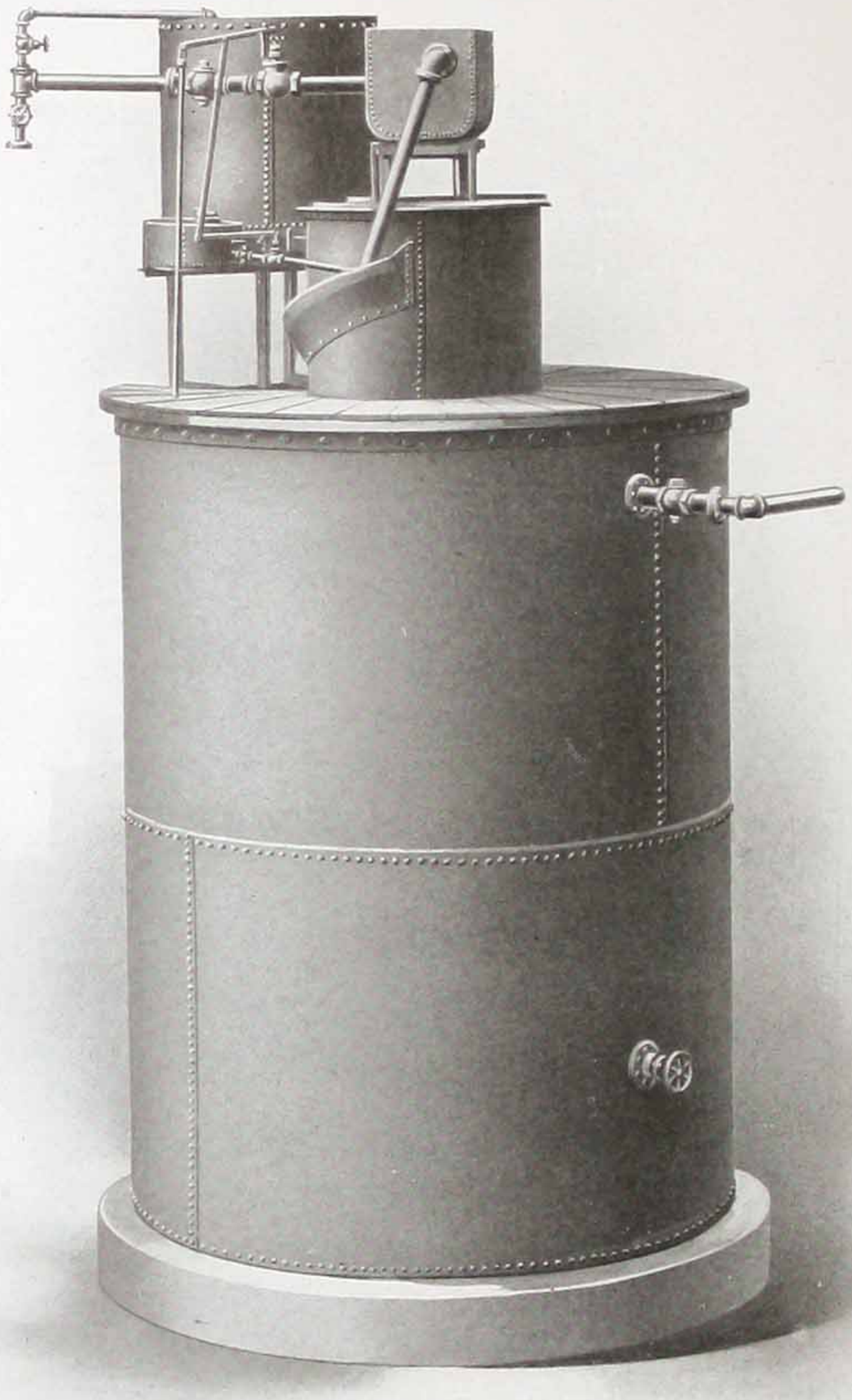
The Syphon System

THIS system is automatic in its operation and is not dependent upon any moving mechanical device for the introduction of the reagents, but depends entirely on the incoming water flowing into a tank, from which leads a syphon. The filling of this tank starts the main syphon, which has auxiliary syphons connected to its long leg. The flow of these auxiliary syphons is controlled by the main syphon.

The water entering the system flows into the syphon tank until a height is reached sufficient to start a flow through the main syphon, which then continues to flow until the tank is emptied. When the main syphon begins to flow, it starts the auxiliary syphons, which introduce the reagents into it during its period of flow. As soon as the tank from which the main syphon operates is emptied, all syphons stop flowing until the tank refills to the point where it again starts the syphons flowing. The harmonious action of these syphons depends upon the head of water in the tank and not upon the rate of flow of the incoming water.

The reagent solution tanks are charged at intervals by a pump from a special tank provided for slaking lime and dissolving other reagents; these solution tanks are equipped with mechanical stirring devices to keep the reagent solutions uniform. Regulating tanks are provided which supply the reagent solution syphons under a uniform head. The water from the main syphon, after the introduction of the reagents, is delivered into a tank fitted with mechanical mixing device and a settling compartment. From the settling compartment it is drawn off by means of a hinged floating outlet pipe, passes to a filter and then to the point where it is to be used.

This system can easily be modified to meet various conditions.



SCAIFE AUTOMATIC TYPE B SYSTEM

(Patent applied for)

Scaife Automatic System

(*Type B*)

THIS system is specially designed for small capacities and is a departure from our standard methods to meet the demand for a low-priced apparatus from users of from 50 to 300 horse power boilers, or from 200 to 1,200 gallons per hour.

The principal parts are as follows: a soda solution tank, a regulator and automatic shut-off; a lime saturator, spiral receiving and mixing trough, reaction compartment settling tank, and wood fibre filter.

The water entering the system is divided into two streams, the main supply being delivered to the mixing trough, and a smaller supply flowing into the lime saturating tank, where it displaces a uniformly saturated lime water into the mixing trough at the same point where the main supply enters. The soda solution from the regulator is also introduced into the mixing trough. The water, after being completely treated and thoroughly mixed in the trough, is discharged with a downward circular flow through the reaction compartment into the settling compartment, then upward through a wood fibre filter to the outlet located near the top of the settling tank.

This system is continuous and automatic in its operation. It is built of steel throughout, is self-contained, and can be installed in a small space. It is simple of construction, and the absence of complicated parts reduces the attention necessary to a minimum.

WE-FU-GO CONTINUOUS SYSTEM

Tower Type

(Patented)

The We-Fu-Go Continuous System

(Tower Type—Ground Operated)

THIS system consists of a tower tank containing separate lime reaction, soda reaction and settling compartments with mechanical stirring devices in the reaction compartments; tank for slaking lime and dissolving soda or other reagents; lime and soda solution tanks with mechanical stirring devices; pump of special design for introducing the solutions into the reaction compartments; electric or water motor or steam engine to furnish power for operating the mechanical stirring devices and solution pumps and either mechanical gravity or pressure filters. With this system under certain conditions where it is desirable to use a lime water instead of cream of lime, we use our patented lime saturator. This system is automatic and continuous in its operation. The treatment is automatically regulated to the quantity of water passing through; the speed of the pumps introducing the reagent solutions being governed by the volume of water entering the system.

The water enters the lower compartment of the tower tank, where it is treated with the first reagent, then passes into the second compartment, where it is treated with the second reagent. Both compartments being fitted with mechanical stirring devices, insures thorough mixing of the reagents with the water, while the sludge of previous purification assists the precipitation.

From the second reaction compartment, the water passes into the upper or settling compartment of the tower. From there it flows to the filters through a floating outlet pipe, which acts as a regulator for the water entering the system.

The settling compartment can be made large enough to give storage of treated water.

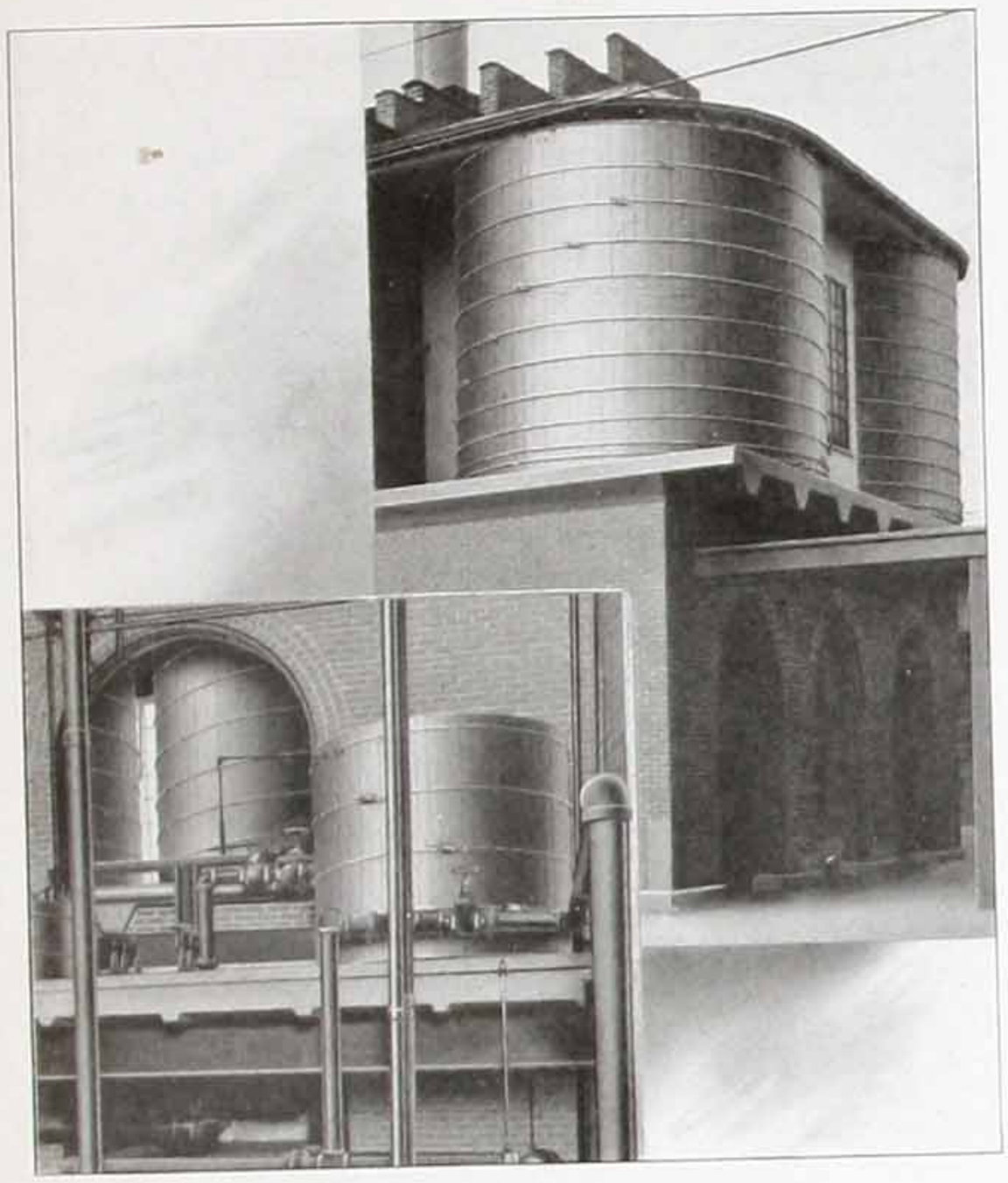
Points of Superiority

FIRST—The operating expense of our systems is the lowest of any on the market. They require so little attention that the labor cost might be disregarded. Everything needful can be done by ordinary unskilled labor.

SECOND—The lowest possible cost of maintenance. Our systems are so designed that every particle of the reagent added is effective. By means of our stirring devices, an intimate mixture of the reagents with the water is absolute and certain, insuring the highest possible value from the reagents in the cheapest and most effective manner.

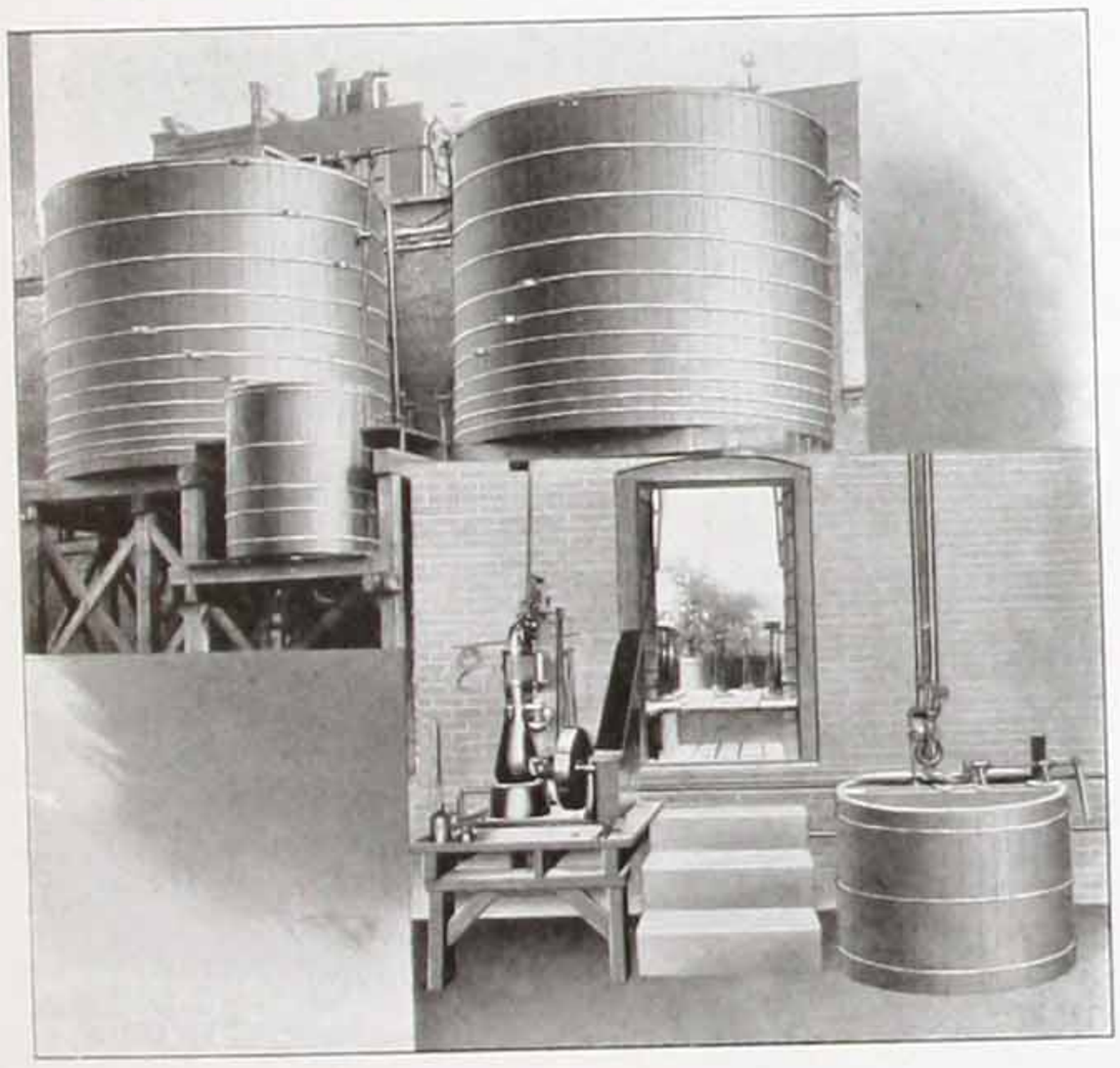
THIRD—All our systems (except the special "Scaife Automatic Type B") are fitted with mechanical gravity or pressure filters, which are washed by reversing the flow of water through them. (See description of our filters.) These filters absolutely insure clear water, and do not require renewing, as do the excelsior or wood fibre filters commonly used for final clarification in many water softening systems.

FOURTH—Every system we sell is designed to meet the specific requirements in each case. We do not have a standard system and make that fit each and every condition and water supply; hence, are not able to carry systems in stock. Each plant is designed and built to meet existing conditions and the kind of water to be treated, taking into consideration the purpose for which the water is to be used. We are therefore able to absolutely guarantee results, knowing just what is to be accomplished; and, from our analyses and experience, are in position to determine just what we can do. We guarantee certain definite results and the cost of treatment, so that you will know just what it will cost you to treat your particular water supply.



1,000 H. P. WE-FU-GO SYSTEM
National Malleable Castings Co.
Indianapolis, Ind.

200 H. P. SCAIFE SYSTEM
A. A. Simonds & Son
Dayton, O.



700 H. P. WE-FU-GO SYSTEM
The People's Brewing Co.
Terre Haute, Ind.

Section of tube from a badly scaled boiler.
The hard scale has been loosened by
action of softened water.

Steam Boilers—Scale

ALL natural waters contain some impurities, and when introduced into a steam boiler the impurities are precipitated, either because the water loses its power of holding in solution these impurities at the higher temperature, or owing to the concentration from the evaporation of some of the water the remainder becomes super-saturated and the excess of impurities crystallizes or otherwise deposits.

A boiler tube entirely filled with scale

When deposited in a steam boiler, these impurities take the form of scale, more or less hard and adherent. This scale is a source of continual expense, through waste of fuel, burned tubes and sheets, shutdowns and frequent cleaning required in order to keep the boiler in condition to make steam. Furthermore, there is always an uncertainty as to the safety of scaled boilers on account of the danger of overheating, due to the insulating effect of the scale.

There are three methods employed to combat the scale evil: first, picking and scraping the surfaces of the boilers and the use of tube cleaning machines. That this method is expensive, laborious and ineffectual is now generally admitted. The second method is the use of boiler compounds, which has been tried and rejected by our best engineers. If effective in preventing the scale, they are injurious in other ways, and in some instances positively dangerous. The third method, the only one that deals with the cause of scale formation, has been in use for years, with good results, and has the recommendation of all engineers and of everyone who has given the subject any serious thought. This method is to remove the scale-forming substances from the water before it enters the boilers.

Steam Boilers—Scale—Continued

It can be clearly shown that the unequal expansion of metal and non-conducting scale, kept cool by the water, tends to loosen and crack off the old scale so that it would fall from the tubes and plates were it not for the new deposit of lime and magnesia, which cements the edges of the old scale to the metal while the boiler is hot. Therefore, if the boiler is fed exclusively with softened and purified water, which has no scale-forming impurities in it, the old scale will not be refastened, but will crack off and fall. This has been the result with hundreds of systems we have installed. Without the aid of compounds, or by any other means than water softened and purified by our processes, we are able to remove all the old scale and prevent the formation of new scale.

A piece of scale showing how scale, loosened by expansion and contraction, is recemented to the boiler by scale-forming matter in the water.

Scale loosened from tube by Boiler Compound, but cemented again by scale-forming substances in the water.

Steam Boilers—Corrosion

THE disintegration of the iron of the steam boiler, by the action of acids and corrosive salts, is of the gravest importance, and is most dangerous. It arises from the concentration of the acids by evaporation. These act upon the boiler material, causing pitting and honey-combing of the most susceptible parts. Of the acids found in water, sulphuric and hydrochloric are the most active in destroying the metal of a boiler. The action of nitric, tannic, acetic or carbonic acid is of milder form, but water impregnated with any of these acids should never be used for steam purposes without previous purification.

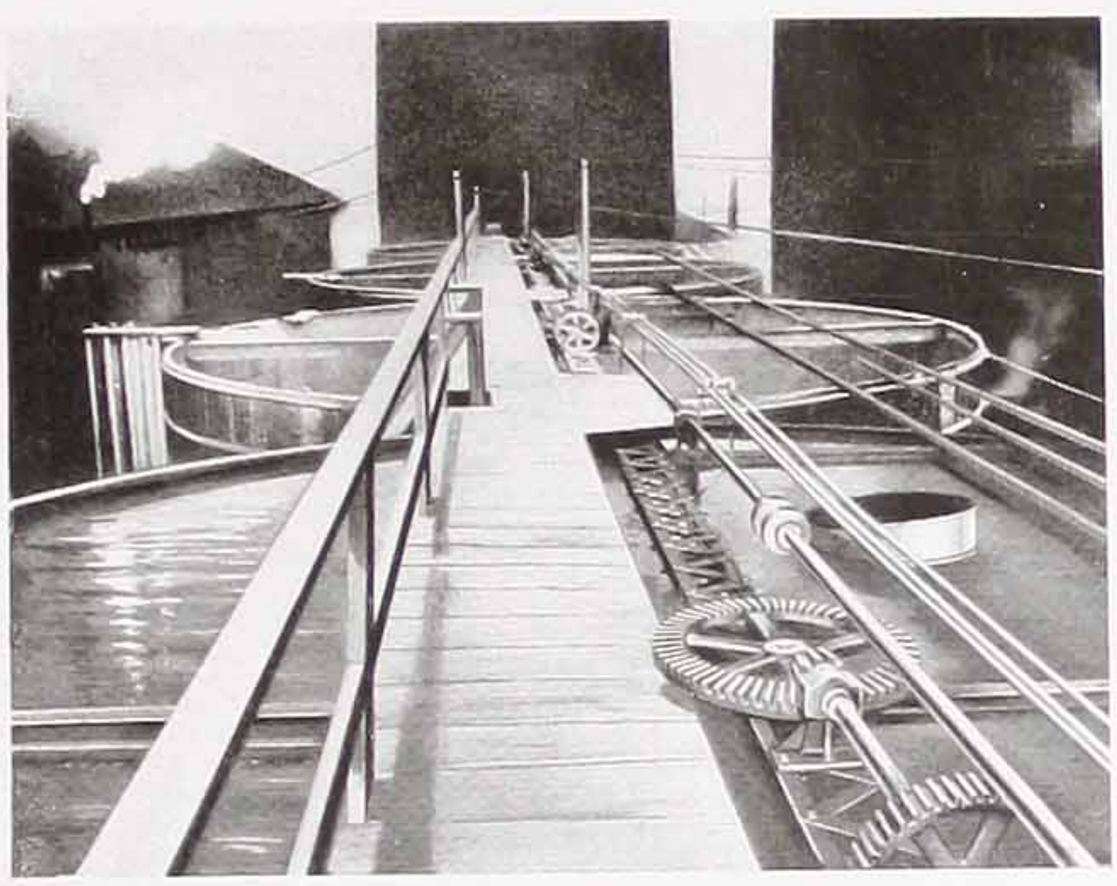
CORRODED BOILER TUBE

The sulphates of iron and alumina, found in many waters, are also corrosive agents, especially when subjected to the heat in the boiler. These substances are decomposed in the boiler, and finally produce a concentrated sulphuric acid which rapidly corrodes the iron with which it comes in contact, as explained above.

Magnesium chloride, under the heat of the boiler, splits up into magnesium hydrate, which is precipitated, and hydrochloric acid, which, next to sulphuric acid, is the most dangerous. Hydrochloric acid is volatile and attacks the steam space of the boilers, as well as every metal surface with which the steam comes in contact.

A fertile source of corrosion is the air dissolved by water, hence it is decidedly objectionable to have any considerable quantity of dissolved air in boiler feed water. All natural water supplies contain more or less carbonic acid, and experience has shown that considerable corrosion takes place due to the mixture of the oxygen of dissolved air with the carbonic acid. The high temperature of water in boilers will also drive off some of the carbonic acid which will be carried with the steam, and cause pitting and corrosion of all metal surfaces with which the steam comes in contact. This is often the cause of the pitting and corrosion of steam piping found in many plants.

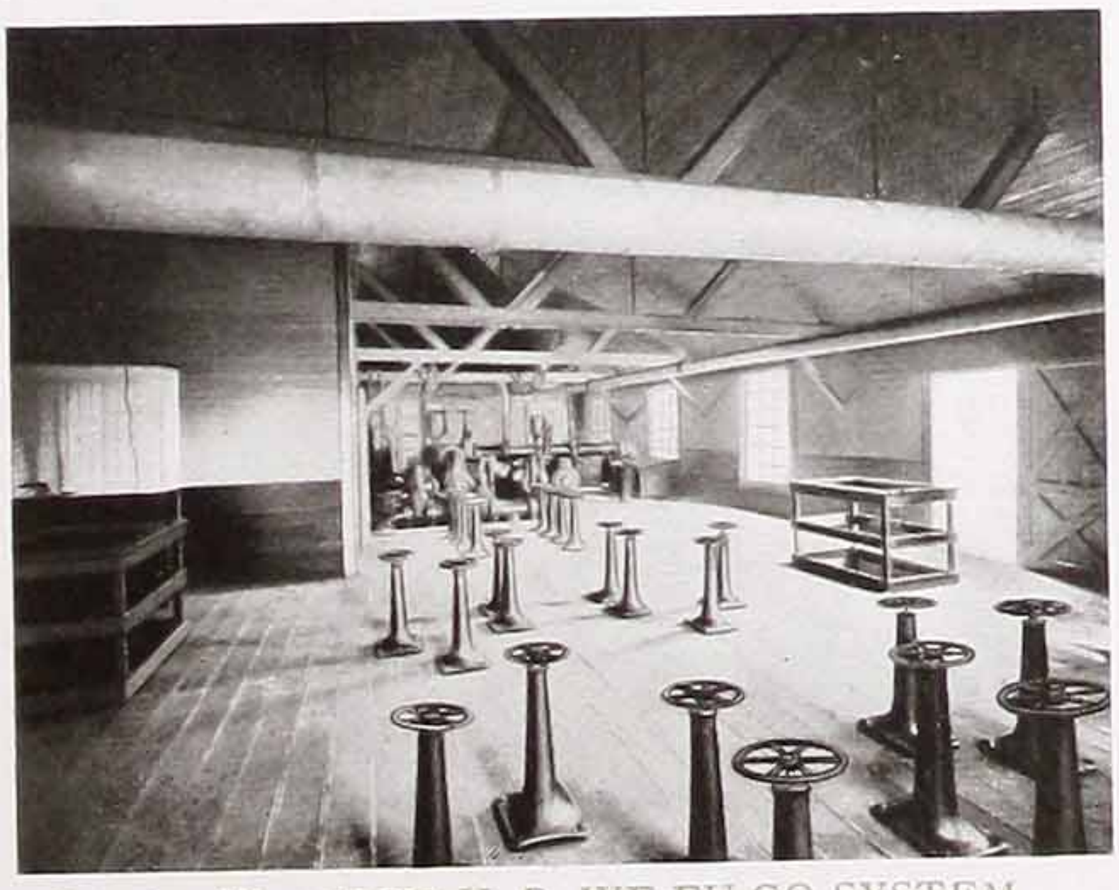
While we use chemicals for softening water, because there is no other means of thoroughly removing the impurities, we wish to state emphatically that we do not use anything which will have an injurious effect upon the metal of the boiler, such as mineral or vegetable acids. The following statement was made by Rear-Admiral John D. Ford, U. S. N., in his report compiled from the reports made by Lieutenant-Commander H. C. Clever, U. S. N., and Commander W. C. Eaton, U. S. N., published in the journal of the American Society of Naval Engineers of May, 1904, as to the kind of water which gives the best results for boiler feed use:



Exterior View 10,250 H. P. WE-FU-GO SYSTEM
National Tube Co.
Wheeling, W. Va.

"This result indicates strongly the wisdom of keeping water in boilers slightly alkaline at all times, as a safeguard against deterioration from oxidation."

The water softened and purified by our systems is always slightly alkaline.

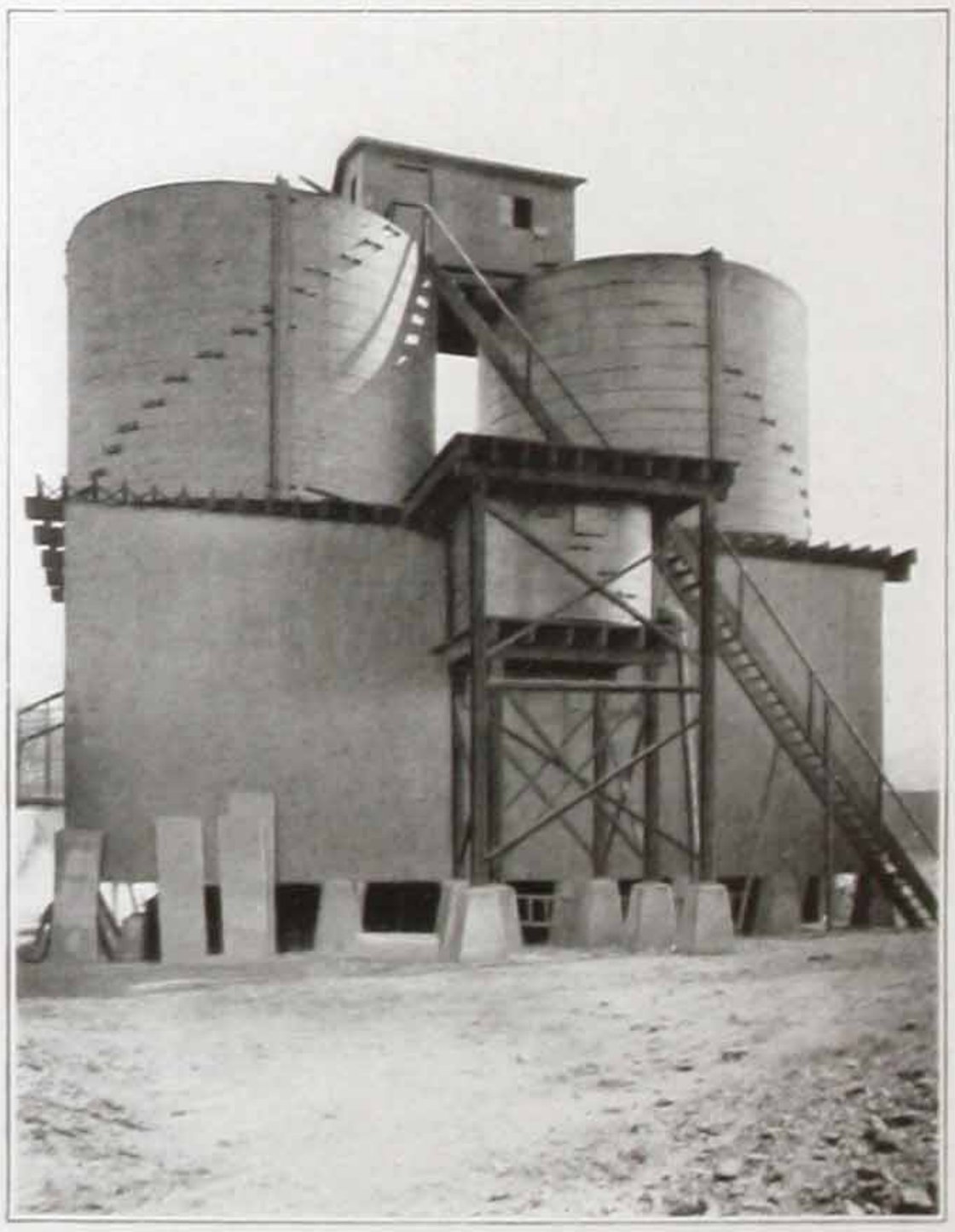


Interior View 10,250 H. P. WE-FU-GO SYSTEM
National Tube Co.
Wheeling, W. Va.

Removal of Oil from Condenser Water

1,000 H. P. WE-FU-GO SYSTEM
The Beckett Paper Co.
Hamilton, O.

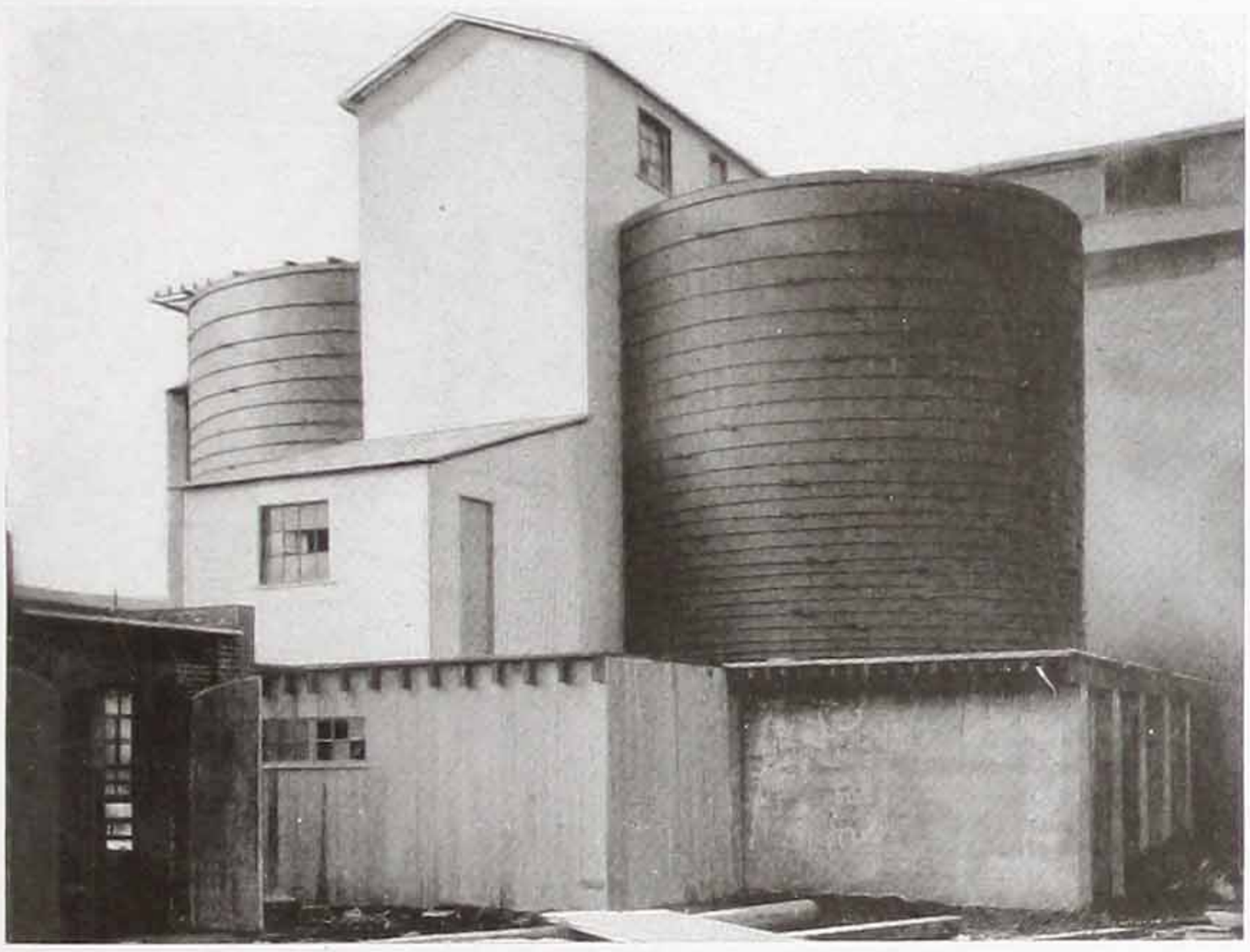
WHEN exhaust steam from engines and pumps is condensed, the lubricating oil remains in a mechanical suspension, forming an opaque, yellowish-white emulsion with the water. To remove the oil from the exhaust steam, a mechanical oil separator is placed between the engines and condenser, but the separator removes only a portion of the oil. Analyses of condensed exhaust steam, which had passed through oil separators, show about 5 grains of oil per gallon, showing that the separator removes only a portion of the oil. By chemical treatment, with our apparatus, we can completely remove this oil, and at the same time remove the scale-forming substances contained in the make-up water. In power plants where the condenser water is discharged into the sewer on account of the oil which it contains, a large saving can be effected by purifying it and using it again for boiler feed. The cost of removing the oil and of softening the make-up water by our methods, with our apparatus, is insignificant when compared with the savings effected.



3,000 H. P. WE-FU-GO SYSTEM
The Struthers Furnace Co.
Struthers, O.

So-Called Water Purifying Devices

BOILER COMPOUNDS—A boiler compound is intended to combine with the lime and magnesia in solution in the water so as to form a precipitate that will not adhere to the tubes and plates of the boiler. Most of them are sold at exorbitant prices, and all of them are irrational in application. The function of the boiler is to produce steam, but the introduction of the compound increases the work of the boiler by making it a chemical retort. Compounds also increase the impurity of the water and form a muddy, insoluble mass that calls for more fuel and frequent cleanings.



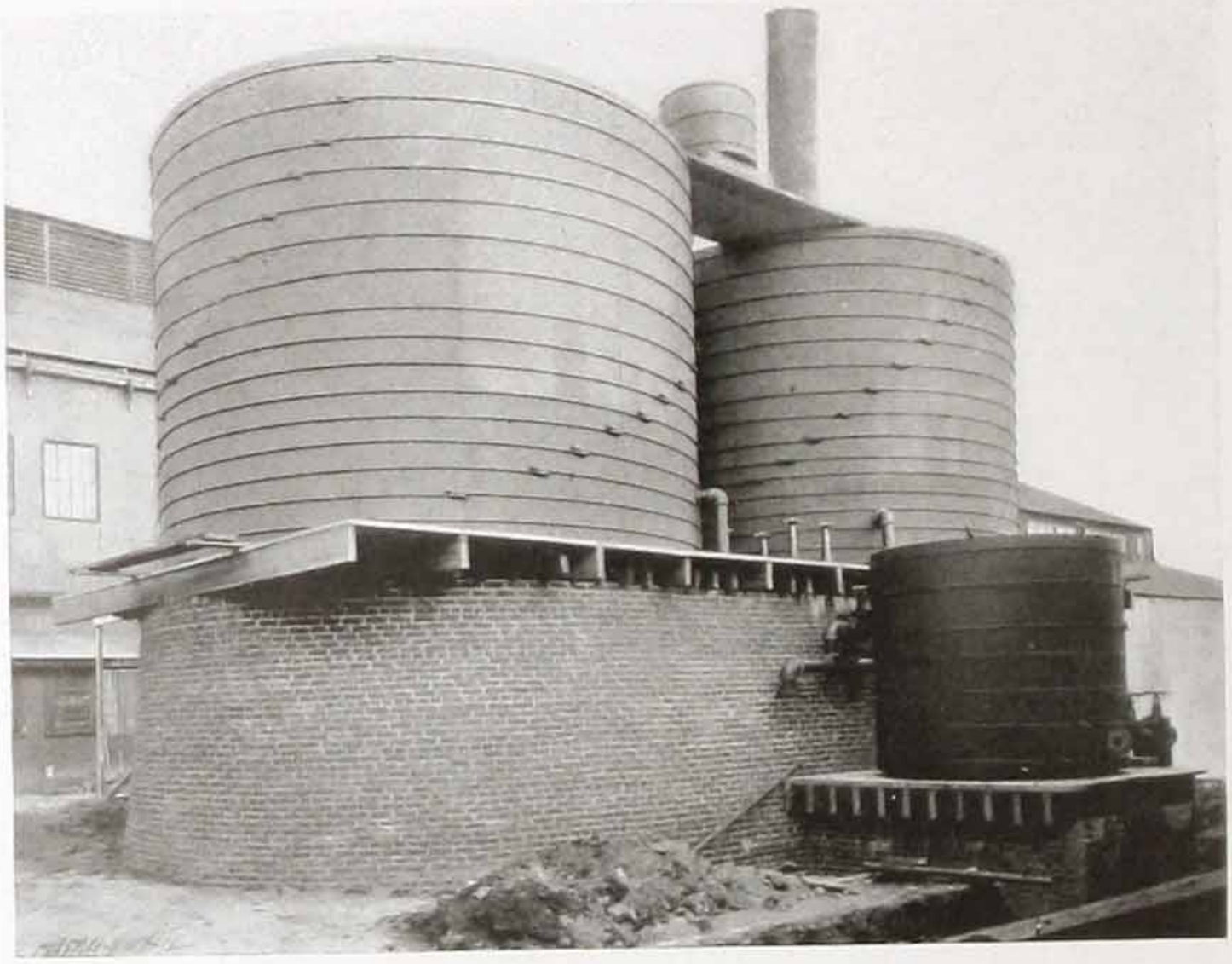
4,000 H. P. WE-FU-GO SYSTEM
Edw. Ford Plate Glass Co.
Toledo, O.

FEED WATER HEATERS*—The carbonates of lime, magnesia and iron are soluble in waters having carbonic acid in solution. When such a water is heated to a temperature of 212° F., and boiled for a time, the carbonic acid is driven off and the carbonates precipitated. This fact is utilized in the ordinary exhaust steam heaters, and is the reason for their being called water purifiers. These heaters are not built of sufficient size, nor is the temperature of the water ever raised to the boiling point, or kept at any constant temperature long enough to drive off all the free or loosely combined carbonic acid, and thus bring about the precipitation of all the carbonates in the heater. Only a portion of them is removed.

Based on the fact that the sulphates of lime and magnesia will start

*(Upon application, we will be pleased to forward pamphlet on "Heaters as Water Purifiers.")

to precipitate at a temperature of 300°; live steam heaters are employed as purifiers. But in practice the water is never thoroughly purified in them, because the heater is usually so small that the water passes through it in too short a time to complete the precipitating process, and furthermore, complete precipitation will not occur without a concentration, which cannot be obtained in a heater.



2,000 H. P. WE-FU-GO SYSTEM
American Sheet & Tin Plate Co.
Muncie, Ind.

FILTERS—Filters remove from water mud and suspended matter, but serve no further as purifiers. The absurdity of all claims to soften hard water by the use of mechanical filters is too apparent to be seriously discussed.

SKIMMERS—Various skimming devices are in use, but it is obvious that they can only remove matter in suspension that forms a scum on the water in the boiler, without producing any effect on the scale-forming substances in solution.

ELECTRICAL TREATMENT—Precipitation can be accomplished by means of electricity, but for practice this method cannot be considered on account of the enormous expense.

SURFACE BLOW-OFF VALVES—This device is of benefit, where extremely dirty water is used, to keep down priming and foaming, by drawing off the dirt that is carried to the surface of the water in the boiling; but this skimming action will not prevent scale formation or corrosion.

Economic Advantages

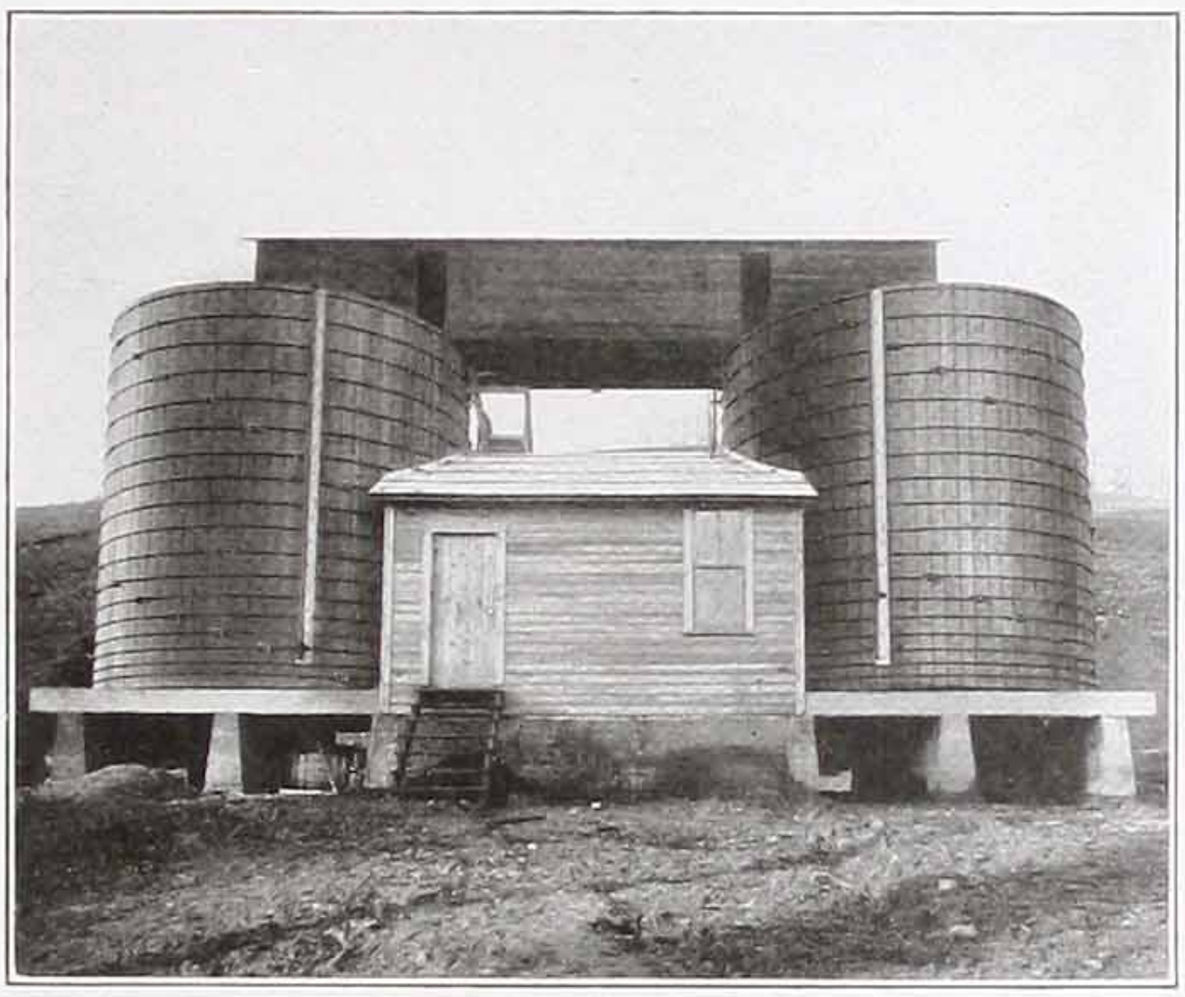
1. Our process saves the labor and incidental expenses of boiler cleaning.

2. The waste of fuel: first, in cooling the boilers, and, second, heating them to steam again, is practically obviated.

3. The removal of the scale-forming and corroding substances reduces repair bills to a minimum.

4. Softened and purified water means clean boilers; consequently, the greatest quantity of steam made per pound of fuel.

5. The efficiency of the boiler is continuous and not intermittent, for, with our apparatus, the boilers are kept clean all the time; while, with bad water, they are clean only immediately after each thorough cleaning.



1,800 H. P. WE-FU-GO SYSTEM
Clearfield Bituminous Coal Corporation
Clearfield, Pa.

6. The heater and economizers will be kept clean and the feed-water raised to the highest possible temperature.

7. The saving in the cost of the reagents we use as compared with the exorbitant cost of boiler compounds.

8. Coal is not wasted in heating a concentrated mass of impurities, as is the case when compounds are introduced into the boiler.

9. The heat is all utilized in the boilers to make steam, and makes it quickly from the soft, clear water which our system provides.

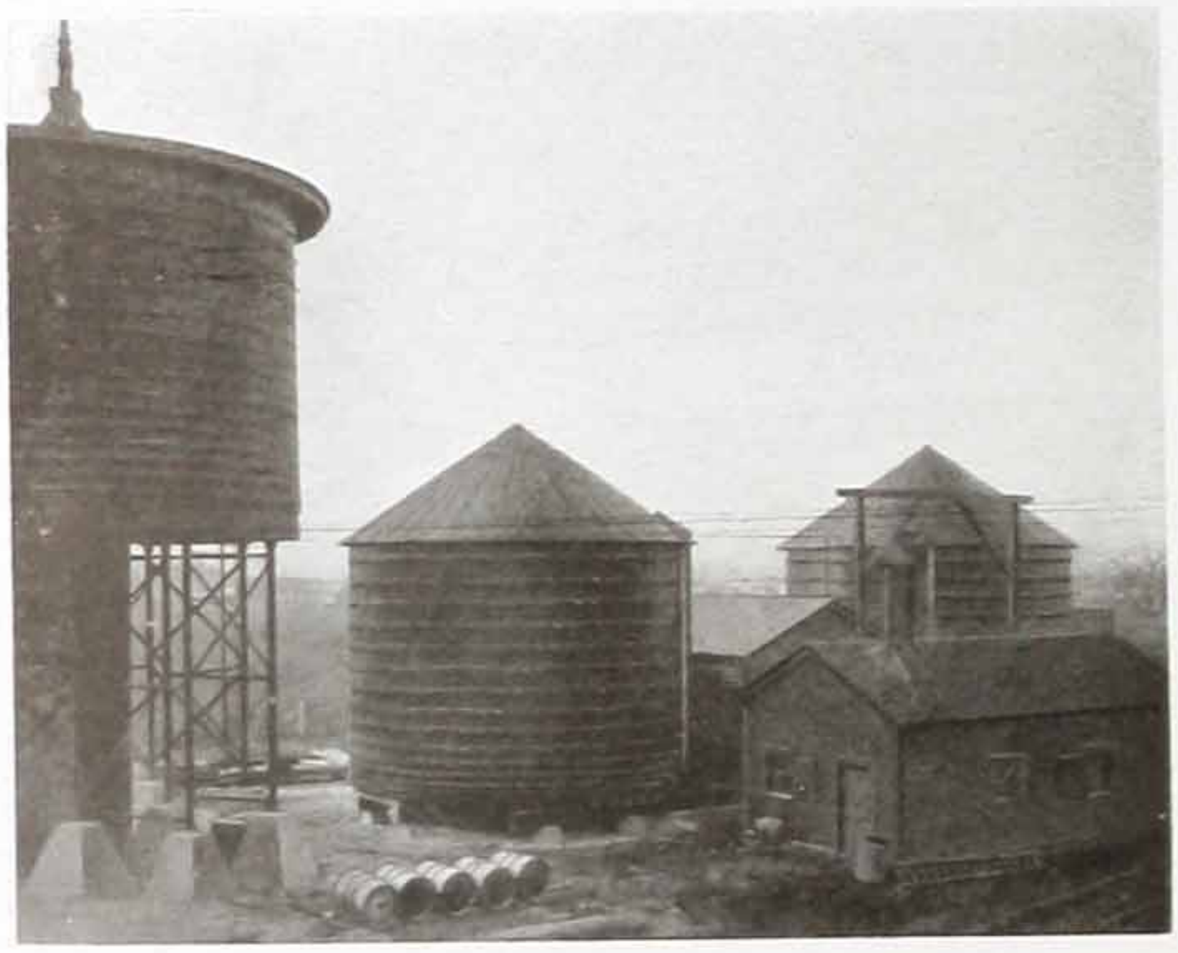
10. As our process keeps the metal of the boiler free from scale, and loosens up all old scale in parts inaccessible to the man who enters the boiler to clean it, a higher rate of evaporation is possible than by any other means.

11. This is the only process which admits of getting the full benefit of the high evaporating power in improved water-tube boilers, because there is no danger of the tubes becoming full of scale and then burning off or leaking.

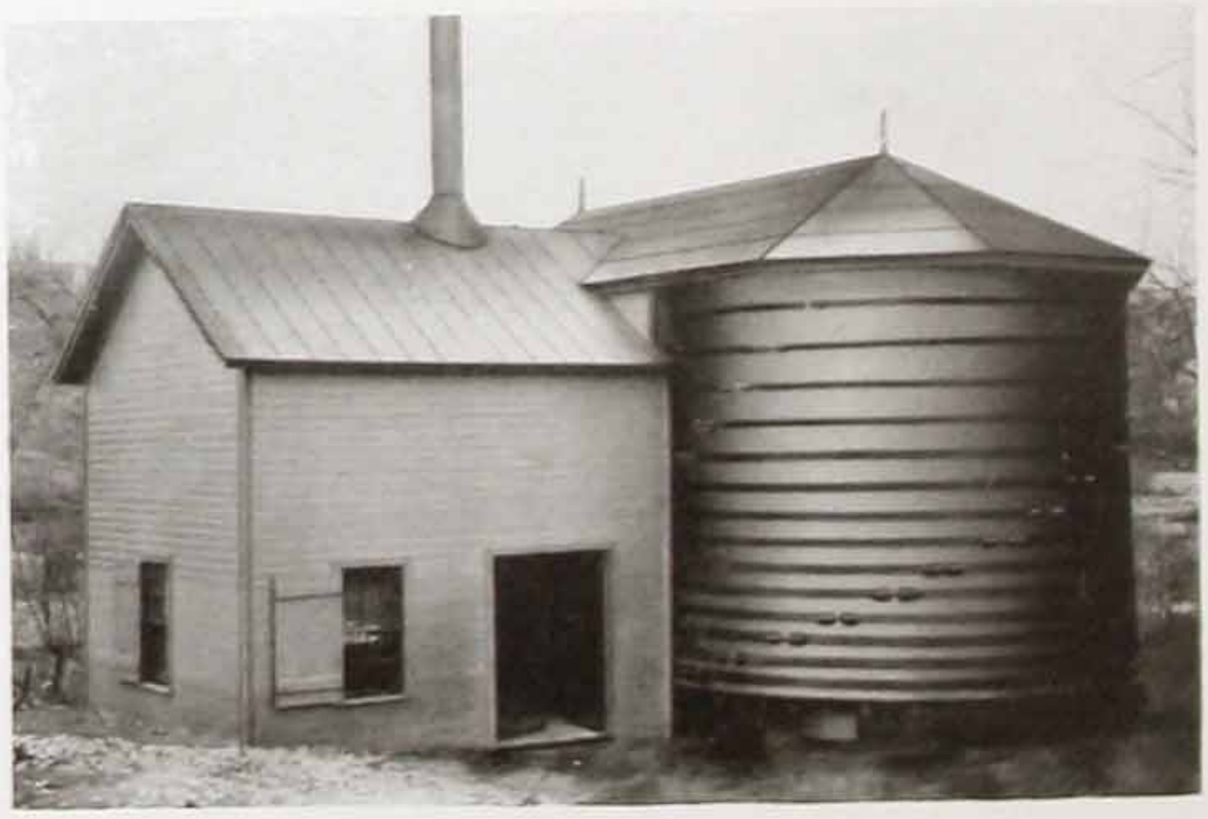
(Upon application, we will be pleased to furnish statements of actual savings effected by the use of our systems, "Water for Economical Steam Generation.")

Railroads

EVERYTHING that has been said in regard to the use of natural waters in steam boilers applies with greater force to locomotive boilers, on account of the high rate of evaporation in them, the greater expense in making repairs, and the vastly greater investment losing its earning power when out of commission. Send for our special literature referring to Railroads.



20,000 gallons per hour WE-FU-GO SYSTEM
C., C., C. & St. L. Ry. Co.
Middletown, O.



10,000 gallons per hour WE-FU-GO SYSTEM
Illinois Central R. R. Co.
Galena, Ill.

Industrial Uses

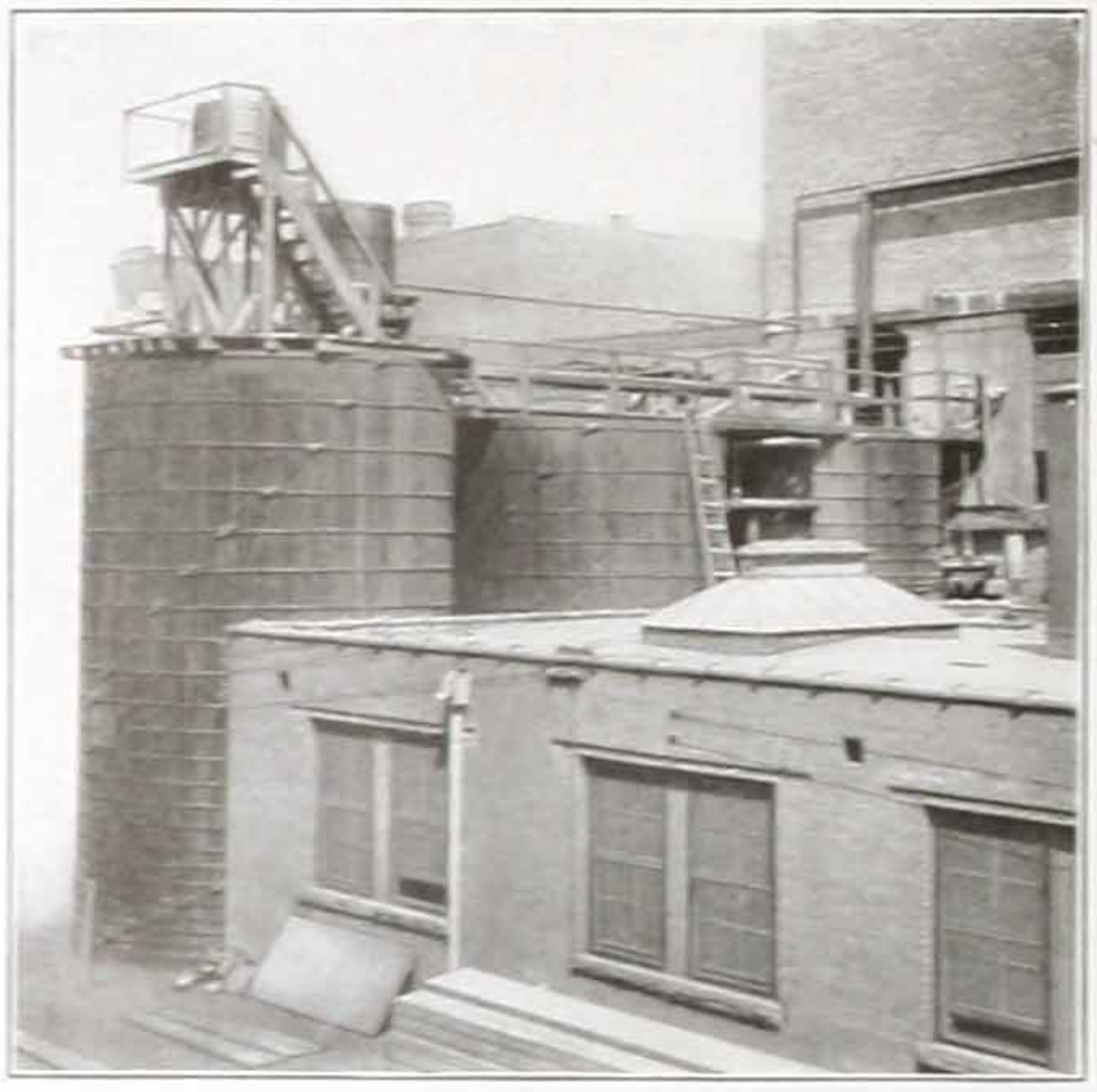
DISTILLERIES—It is highly important that the water for distilling should be free from organic matter, iron oxide, magnesium carbonate, calcium chloride, calcium carbonate and mineral acids. After making a special study of each case, we adopt a method of purification that will provide a water free from all harmful impurities. Water properly softened by our process is just as reliable as distilled water for rectifying spirits.

BREWERIES—For breweries we build a special plant, designed to treat water for the brew. This treatment removes the organic matter, iron and magnesia, reduces the calcium carbonate to a favorable limit and permits the addition of the desired amount of calcium sulphate. We guarantee that dry steam made from water which has been purified by our process for boiler feed will not in any way affect or contaminate the product of the brewery. This point is vouched for by eminent chemists employed by brewers to examine the water. One prominent brewer's chemist, after analyzing a sample of water sent him by one of the brewers using our system, pronounced the water **"ideally adapted for every brewery use."**

500 H. P. WE-FU-GO CONTINUOUS SYSTEM
United Zinc & Chemical Co.
Argentine, Kan.

ICE FACTORIES—Pure water is of vital importance in the manufacture of ice, both for feeding boilers and for ice-making. It is of great importance that the water should be free from organic matter and from all dissolved gases. Our precipitating process, which removes the lime, magnesia and iron from the water, also removes the mud and other suspended impurities, together with all organic matter. This pure water fed to the boilers is in the best possible condition to give the purest steam, and hence the purest distilled water. In plate ice plants, using water properly softened and clarified, the rate of freezing is increased and the freezing compartments need not be so often emptied and refilled with fresh, warm water.

CONDENSING AND COOLING WATER—Condensing or cooling water may be so purified as to eliminate the expense and trouble due to lime crusts. This is of special value in the double pipe type of condensers now in general use in ice factories. By means of special apparatus, we can remove the temporary hardness and corrosive substances at a very low cost. Anyone using gas engines will appreciate the necessity of clean water, free from temporary hardness or corrosive substances, for use in cooling jackets.

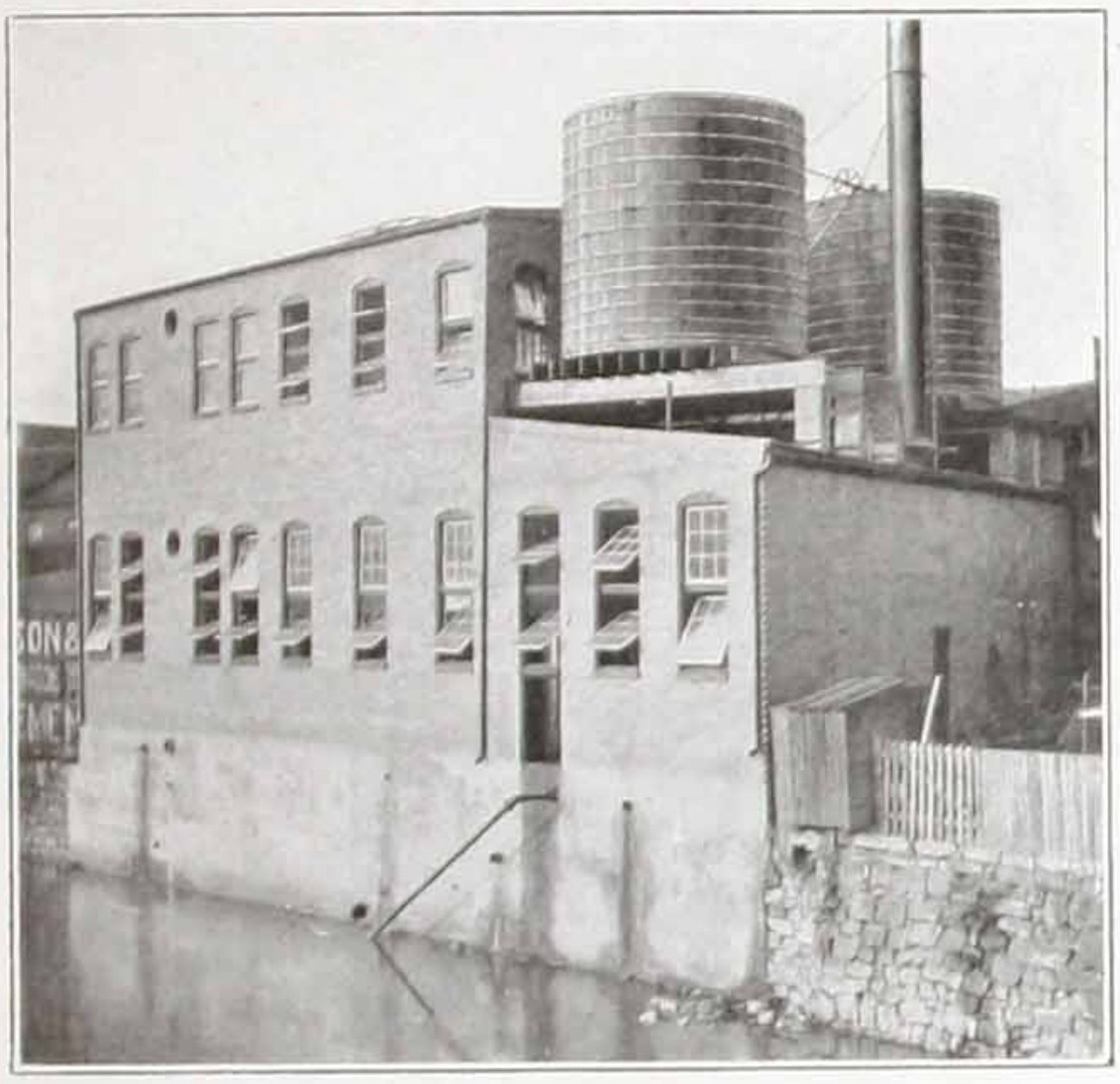


32,000 gallons per hour SCAIFE AUTOMATIC SYSTEM
Buffalo Cold Storage Co.
Buffalo, N. Y.

FOR TANNERS AND EXTRACT MAKERS—If a water contains carbonates of lime or magnesia, the quicklime for removing the hair will cause a precipitation of these carbonates in the hides. This deposit interferes with the absorption of the tannin in the cells of the hides, retards the tanning process, and causes a fluffy grain and an uneven color. A water containing in solution only 10 grains of carbonates of lime and magnesia per gallon will destroy from 11½

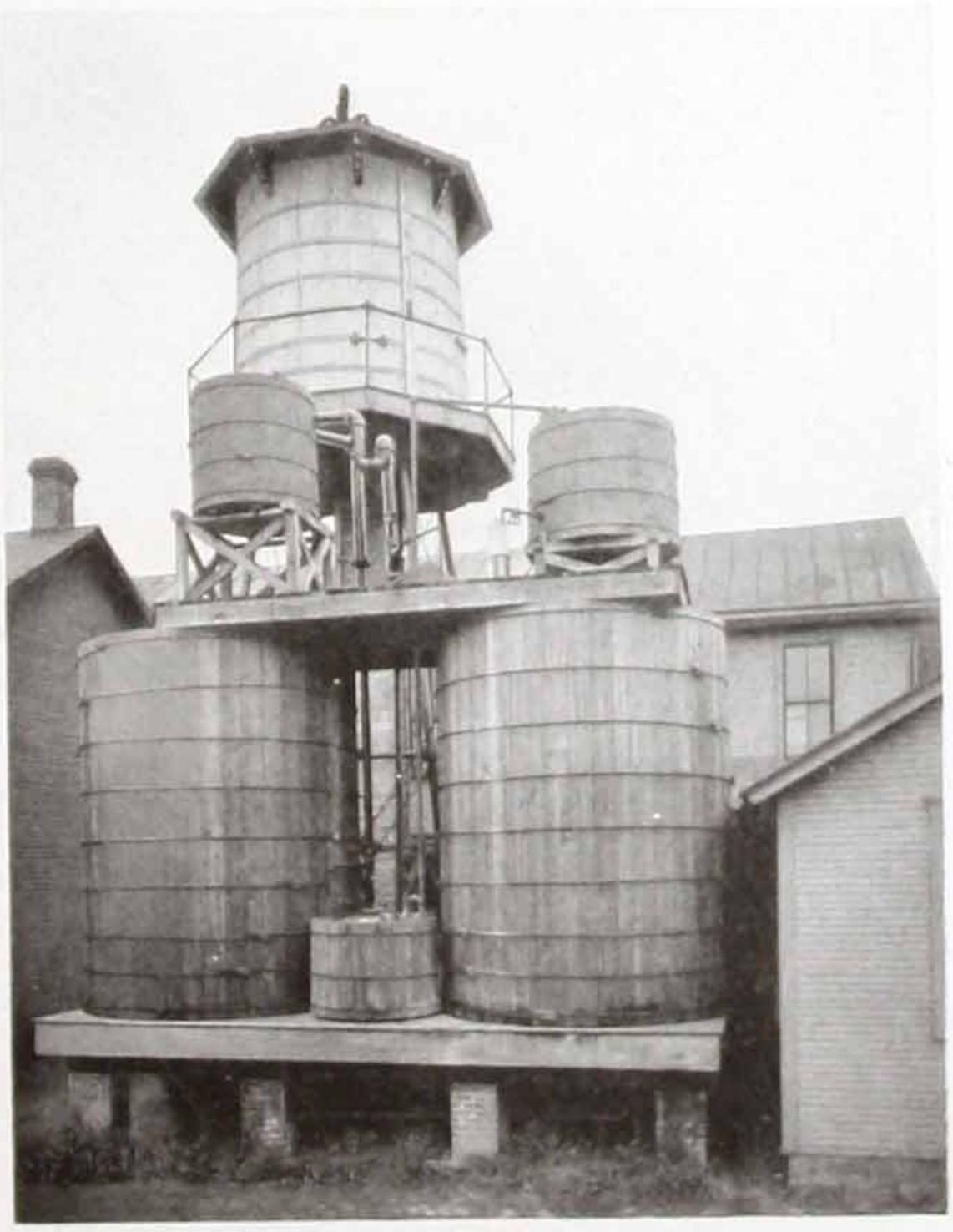
1,250 H. P. WE-FU-GO SYSTEM
The Geo. Wiedemann Brewing Co.
Newport, Ky.

to 13½ lbs. of tannin per thousand gallons of water, or about 50 lbs. of 25% extract, which, at 3c a lb., would cost $1.50. This same water could be softened at a cost of less than ½c per thousand gallons.



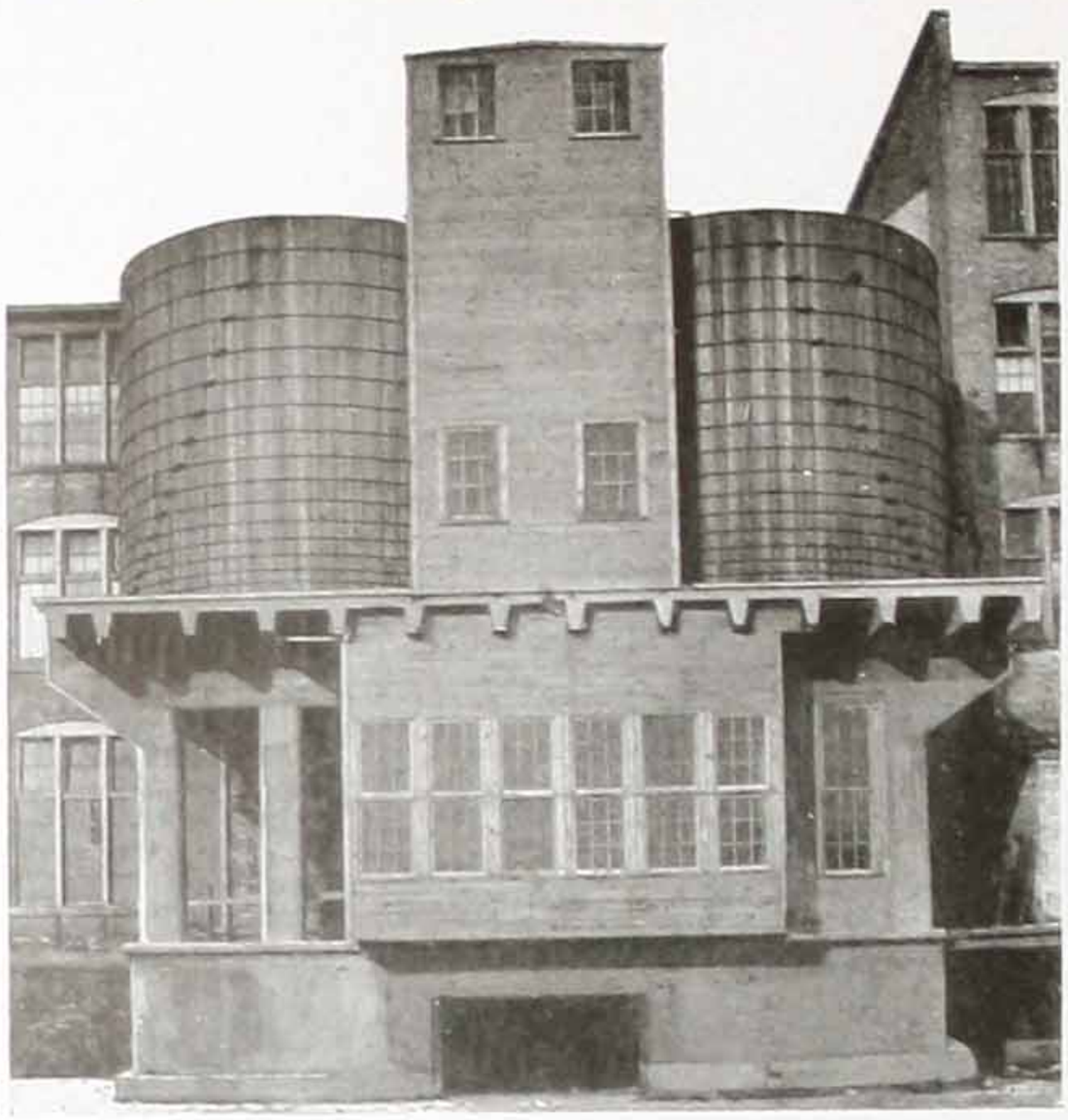
3,000 gallons per hour WE-FU-GO SYSTEM
Crystal Laundry
Cumberland, Md.

LAUNDRIES—With hard water, soap is wasted, lime curds formed adhere to the meshes of the cloth, more water is required for washing, the blueing does not dissolve evenly and goods are frequently streaked; white goods are streaked and become a dirty gray, especially at the seams, due to lime curds, and the cloth is stiff and harsh. Using hard water, 1.4 lbs. of soap is destroyed per thousand gallons used, for every grain of carbonate of lime per gallon the water holds in solution. With softened water, the washing can be done with less water and much smaller quantity of soap, and in shorter time with less labor. No soda or washing compounds are required, no lime curds are formed, the cloth is uniform in color and is not stiff and harsh; flannels and woolen goods look better and are softer.



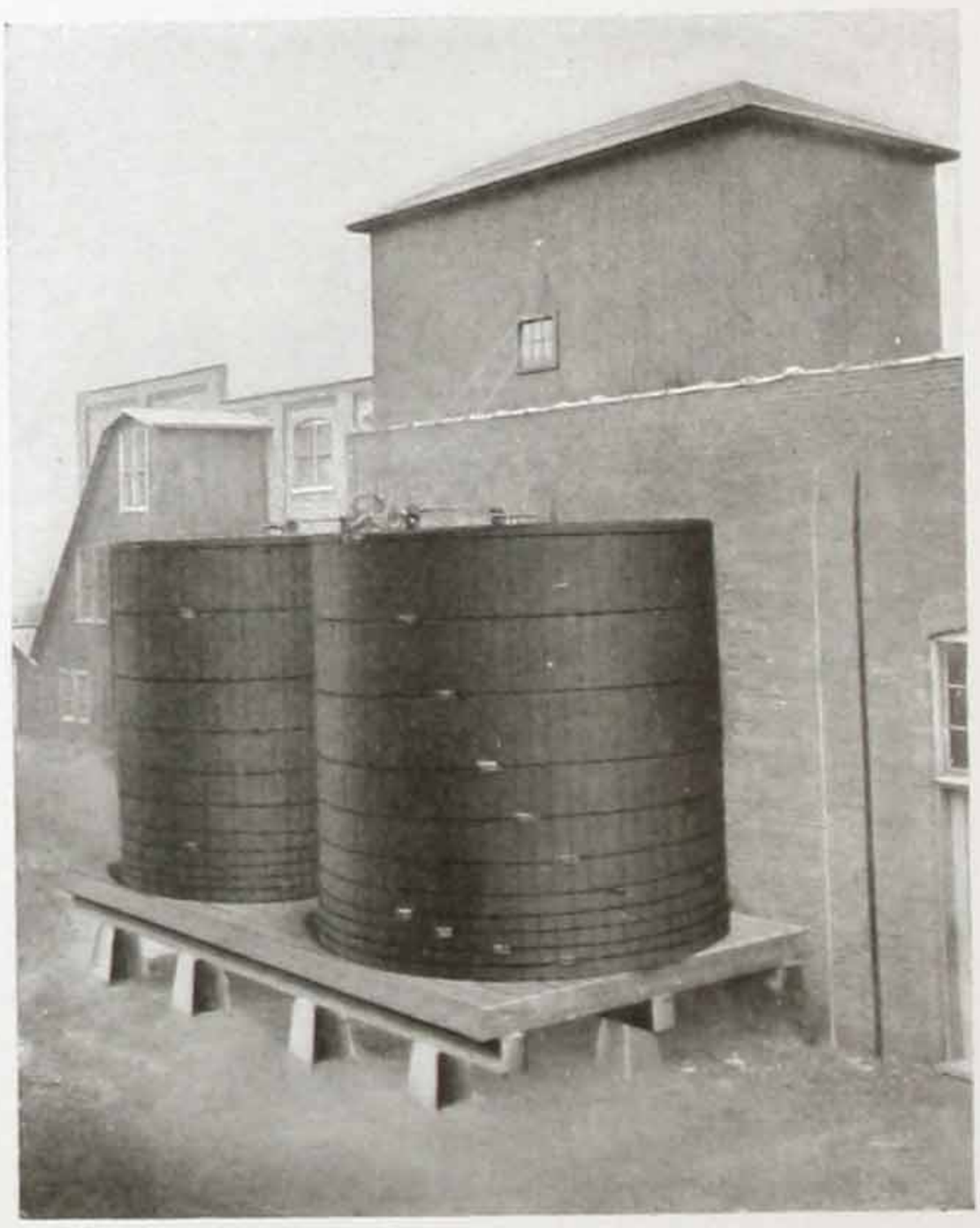
1,000 gallons per hour SYPHON SYSTEM
Latrobe Steam Laundry
Latrobe, Pa.

COTTON, WOOLEN AND SILK MILLS—Soft water absolutely insures a perfectly even surface for dyeing, the least waste of dye stuff, uniform coloring, and superior color, texture and appearance. (Send for our special literature.)



10,000 gallons per hour WE-FU-GO SYSTEM
Rockford Mitten & Hosiery Co.
Rockford, Ill.

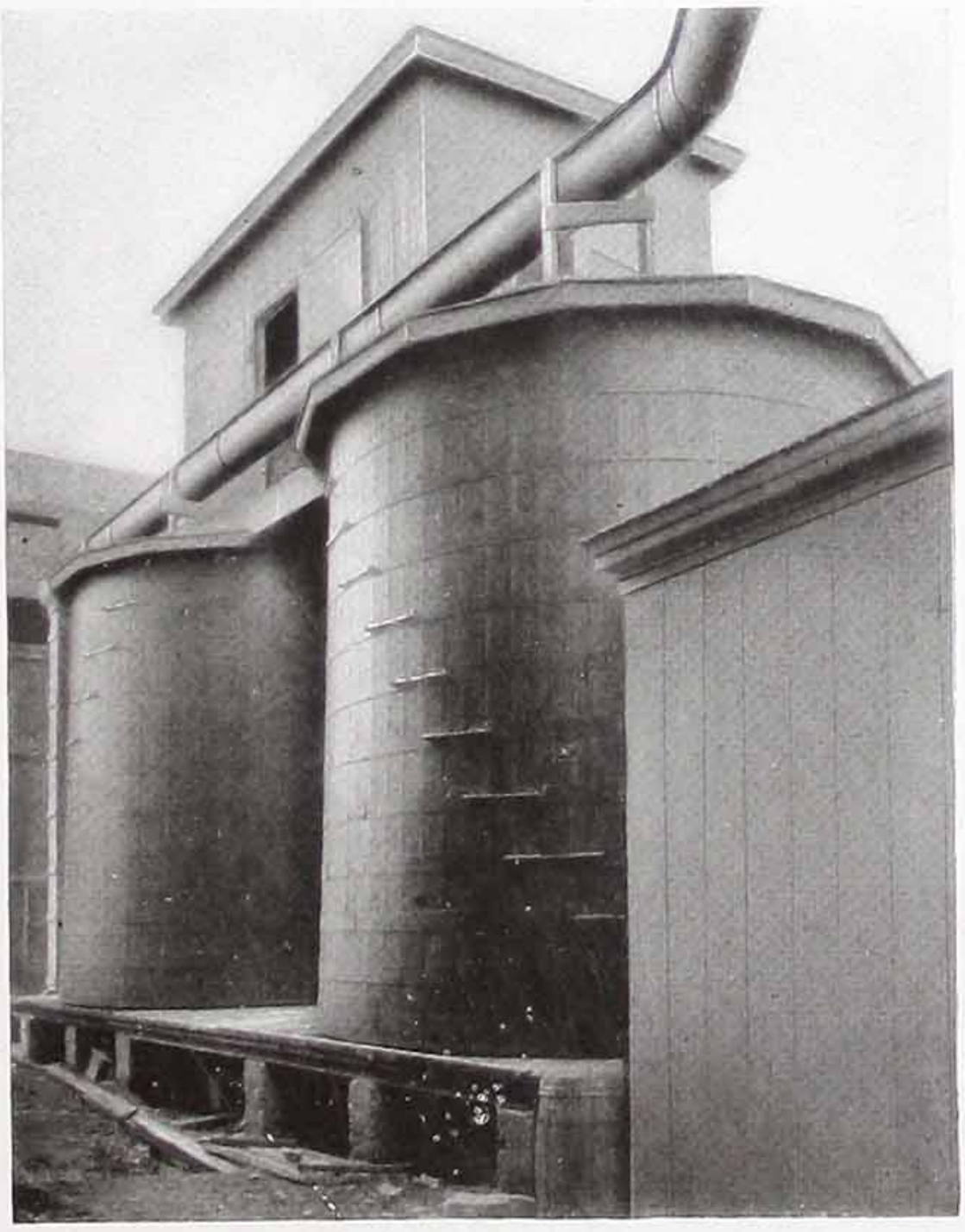
PAPER MILLS—The important quality of water, from the paper maker's standpoint, is to have it free from any impurities that will affect the color of the product. For washing paper-pulp, soft, clear water is desirable and even necessary, owing to its solvent power. The use of hard water increases the quantity of size required and reduces its efficiency by forming insoluble precipitates of lime and magnesia in the water. When the water supply is derived from streams, it becomes unfit for use after heavy rains on account of the great quantity of finely divided soil carried in suspension. A filter will remove the suspended matter, but will not remove the lime, magnesia, etc., in solution. Our system for softening and purifying will remove both suspended matter and objectionable solids in solution.



4,000 gallons per hour WE-FU-GO SYSTEM
The Mentor Knitting Mills Co.
Mentor, O.

OTHER INDUSTRIAL USES FOR GLUE FACTORIES, SUGAR REFINERIES, STARCH FACTORIES, SOAP FACTORIES, CHEMICAL WORKS, ETC.—When the water contains objectionable impurities, we can remove them by special apparatus designed to meet the specific requirements in each case.

10,000 H. P. WE-FU-GO SYSTEM
Armour Packing Co.
Kansas City, Mo.



1,250 H. P. WE-FU-GO SYSTEM
The Cincinnati Brewing Co.
Hamilton, O.

Filtration

MECHANICAL filtration of water is the intelligent application of chemical and physical laws, for the combining or gathering together of the finely divided suspended matter contained in all natural supplies, so that it can be readily removed by passing the water through a bed of sand or quartz contained in a suitable tank.

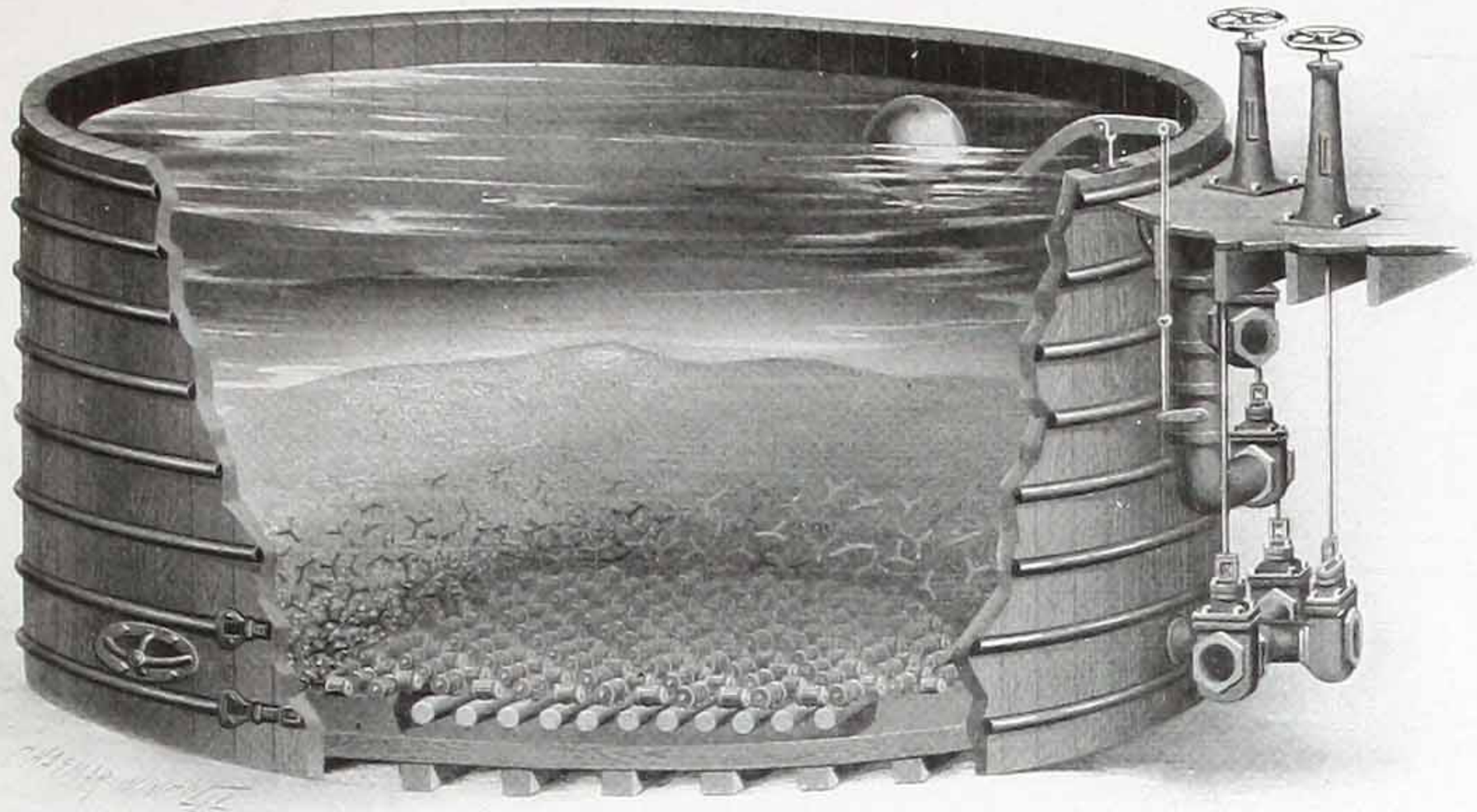
In general, mechanical filters may be divided into two classes or types—gravity, or open filters, and pressure, or closed filters; each giving the same results when properly designed and operated.

1,000,000-gallon GRAVITY FILTER SYSTEM
Lancaster Mills, Clinton, Mass.

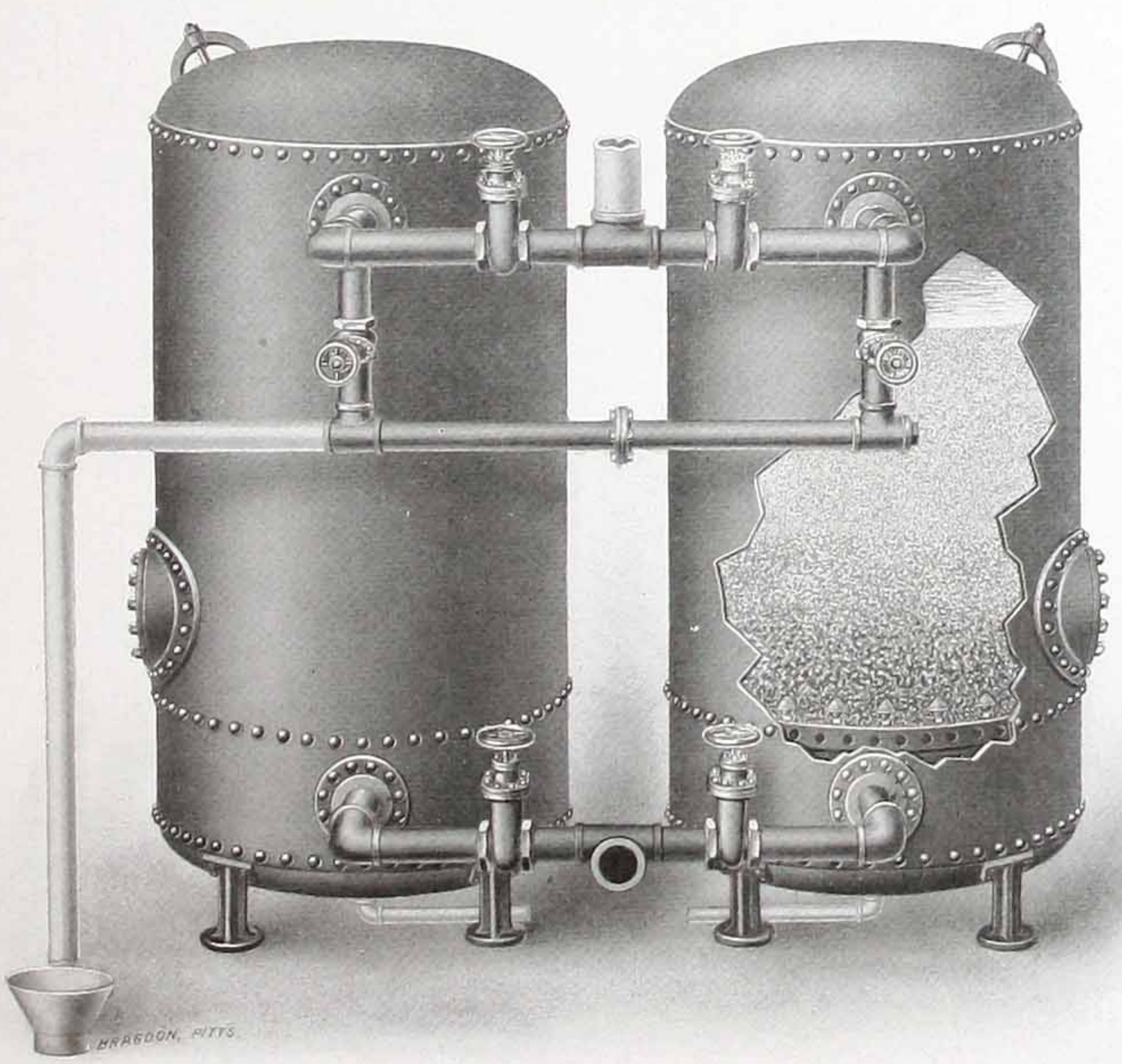
GRAVITY FILTERS are designed to operate with the natural gravity pressure of the water in the tank above the sand-bed. Being open at the top, they can not be forced beyond a certain limit, and thus insure certain and accurate results. They are especially adapted for cities, towns and industrial uses.

Our mechanical gravity filters are simple in design and operation; and our long list of satisfied users is evidence of their efficiency. They are built in units, with capacities varying from 8,000 to 1,000,000 gallons per 24 hours each. Having such a wide range of sizes, we can furnish combinations for practically any required capacity. The filtering medium in these filters is the best grade of silica sand, which is graded to meet the requirements of each case.

The strainers are of our patented type, screwed into manifolds

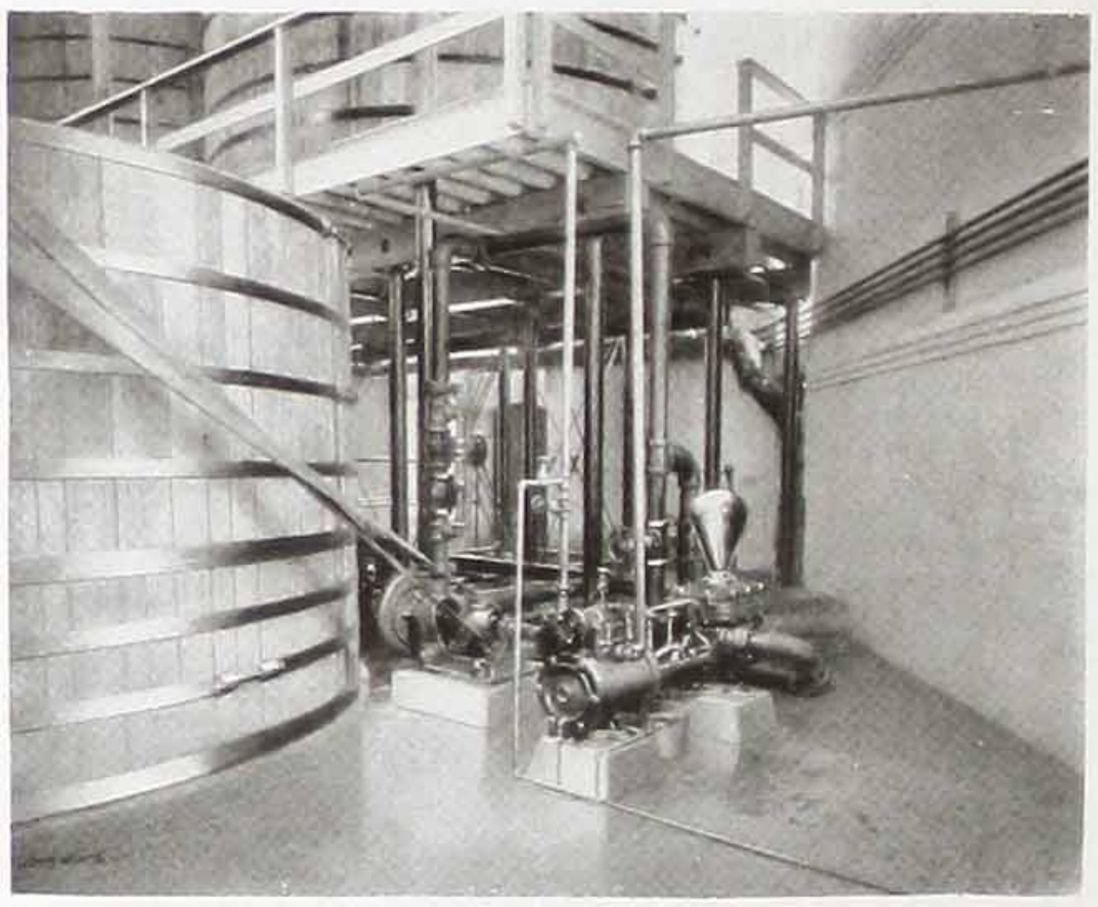


MECHANICAL GRAVITY FILTER



MECHANICAL PRESSURE FILTER

in the bottom of the filters, and are so designed and arranged that each square foot of the filter carries its proper quota of water. This manifold is imbedded in concrete to the base of the strainers. By means of our strainers the wash-water introduced into the manifold system is uniformly distributed over the entire filter area, thus obtaining the full effect of available pressure and insuring the highest efficiency from the wash-water.



1,000,000-gallon GRAVITY FILTER SYSTEM
Lawrence Mfg. Co., Lowell, Mass.

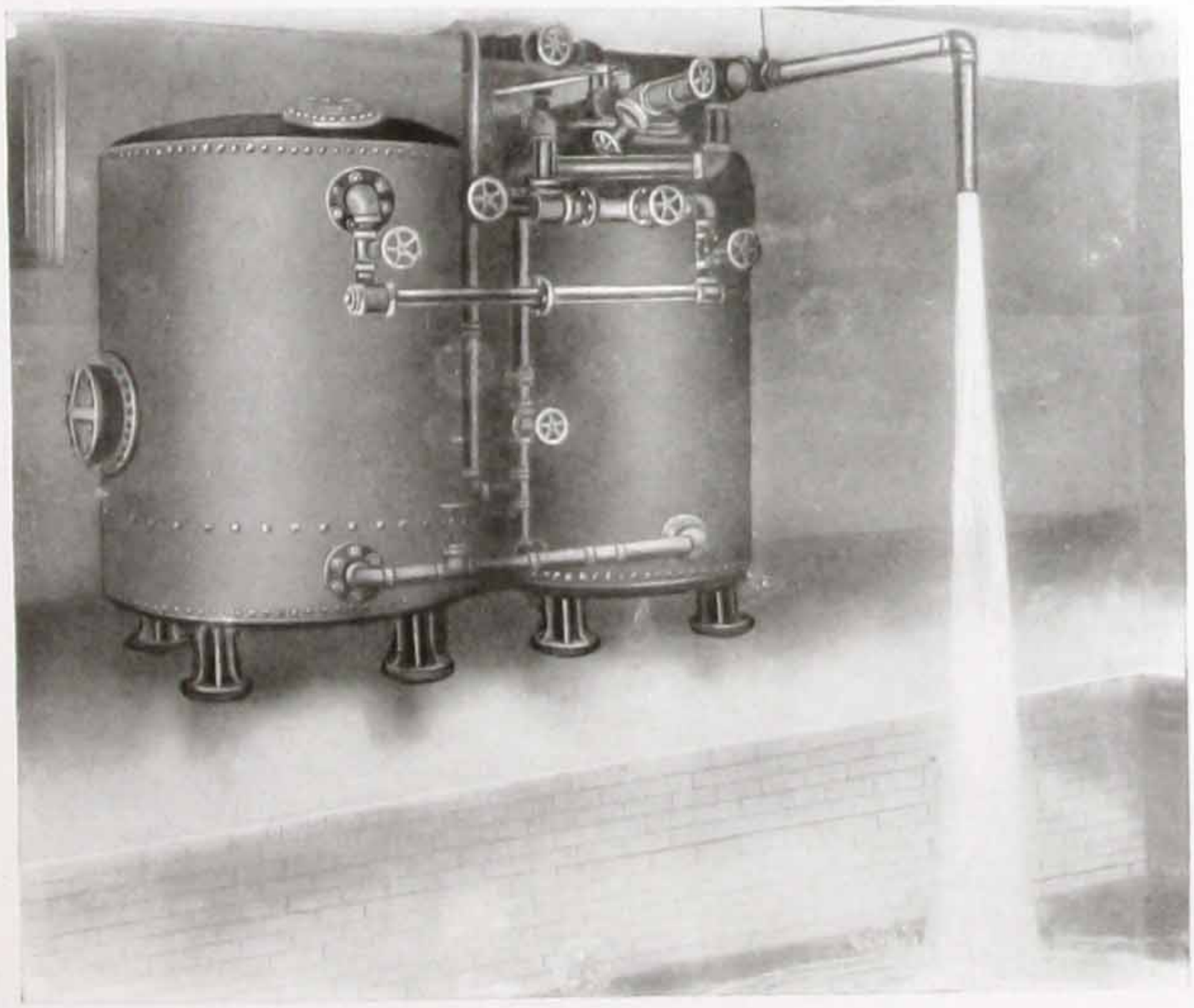
On account of the finely divided mud, silt, bacteria, and other suspended matter contained in natural waters, much of which is invisible to the eye, it is often necessary to use some means of coagulating or gathering together these impurities, so that they can be removed by the filter-bed. Even though the filter-bed be made up of very fine sand, it has interstices visible to the eye, through which the fine matter would pass, unless previously coagulated. Where the quantity of these impurities is large, we use a specially designed sedimentation tank, to allow time for the action of the coagulant, and for the precipitation of the greater part of these impurities, thus reducing the work which otherwise would fall on the filter-bed and necessitate more frequent cleaning.

The PRESSURE FILTER is particularly adapted for small units, where space is a consideration, such as in public institutions, schools, residences, office buildings and small towns.

Filtration—Continued

The Scaife Patent Pressure Filters are adaptable for every industrial purpose, and are built in capacities from 20 gallons per hour upward. These filters are built to withstand any required pressure, and are furnished with the Scaife patent improved brass strainers. When operated in pairs, each filter is cleaned with filtered water--one filter furnishing the water for cleansing the other.

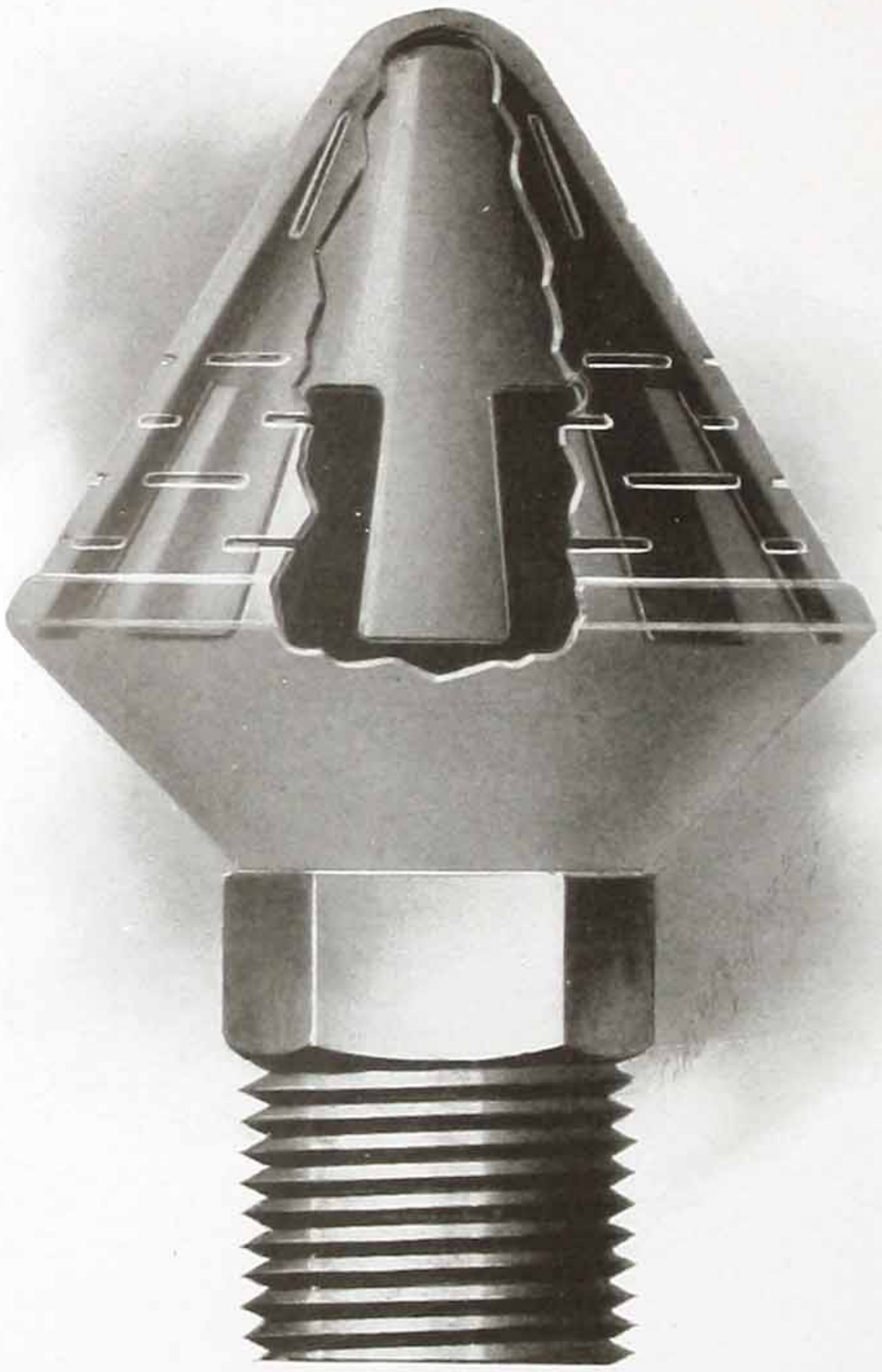
We issue a separate catalog, devoted exclusively to Scaife Pressure Filters, and their wide range of application, which will be mailed upon request.



1,000 gallons per hour PRESSURE SYSTEM
East Liberty Natatorium, Pittsburg, Pa.

Strainers

WE use several types of strainers, each especially suited for the purpose for which it is to be used. Generally speaking, no strainer gives any trouble in the ordinary operation of filters; that is, in allowing the filtered water to flow down through it; but in the washing process, a perfect distribution of wash-water, at reasonable pressure, into every part of the filter-bed, is absolutely essential to get good results in the shortest possible time. This is accomplished by our conical strainer, which is so built that the water has ample area for leaving the filter-bed; but in the washing the inner cone moves up and closes a certain number (varied to meet conditions) of the openings; thus making it possible to get full pressure evenly distributed through the filter-bed, with a minimum quantity of wash-water.



CONICAL STRAINER
(Patented)

We are the first to entirely prevent the trouble and annoyance due to the filter-bed becoming packed. In fact, this is a characteristic objectionable feature of all other filters. We require no "stirring devices," "perforated discs," "slotted plates," "wire screens," or any other of the numerous inefficient means adopted by others to circumvent this difficulty. The strainers in ordinary filters are nothing more than a round disc punched with small holes or slots.

THE CORDAY & GROSS COMPANY
PRINTERS ENGRAVERS DESIGNERS
CLEVELAND